PREFACE

1 A rapid survey of the existing industries and of the potential industrial resources of Orissa was undertaken with a view to provide a basis for the planning of post war development of industries in the Province The object of the survey was to find out the number, type and capacities of the industries which already exist and the availability of resources, i e , raw materials, fuel or power, labour and market for the development of new industries or the expansion of the existing ones It must be emphasized that a detailed report for a scheme of this nature would necessarily take a long time to complete but as the information was required urgently it has neither been possible within the short time available nor is it necessary at this stage to collect detailed information and statistics about the various industries The report is, therefore, based on such information as could be readily obtained The principal object of the survey was to find out the possibilities of starting new industries As the report has been prepared in a very short time, it gives only the results of a preliminary investigation and deals only with the salient features Before any scheme can be taken in hand a detailed survey will have to be carried out It is, however, hoped that this rapid and general survey will help to focus attention on those industries which seem to be suitable for this Province so that a proper selection of the best possible ones may be made A more comprehensive survey for the compilation of fuller data on these industries will have to be undertaken at a later date

2 In drawing up this report the classification of industries as given in Government of India's letter No 69 R C , dated the 22nd September 1944, has been followed because this will facilitate its consideration by the Policy Committee for industries that is to be set up at the Centre under the Chairmanship of the Hon ble Member for Planning and Development and by the various industrial panels to be set up to consider the development of industries and make recommendations to the Government of India Information on the existing industries, if there are any, has been given at the beginning and on Cottage Industries at the end of each section or chapter A brief description of the process of manufacture has been given where necessary with a view to show the relative importance of the various raw materials used in the manufacture while a somewhat detailed information has been given regarding the availability of the raw materials at different localities in Orissa Those industries which could not be conveniently included in the classification mentioned above have been discussed under miscellaneous industries in a separate chapter

3 To survey however cursorily so many industries in so short a time is rather a strenuous task, but it has been a very pleasant experience to study and acquaint oneself with so many interesting things within this brief period It is indeed a matter of great pleasure to me to express my sense of deep gratitude to Mr B K Gokhale, CIE, ICS, Adviser to His Excellency the Governor of Orissa in the Department of Planning and Reconstruction, for having given me this splendid opportunity to study at first hand the possibilities of industrial development of my Province I am highly grateful to him for the valuable suggestions and advice he gave me at the time of putting me on to this enquiry They have served me as a guide throughout the course of my investigation I would also thank Mr A H Kemp ICS, Secretary to the Government of Orissa, Department of Planning and Reconstruction and Mr H Lal ICS Director of Development, Orissa, for their helpful suggestions and for making available to me all information available in their departments I have made a free use of the valuable report on Cottage Industries drawn up by Rai Bahadur Bhikari Charan Patnaik who possesses a vast knowledge about the Cottage Industries in Orissa and is intimately connected with some of them I have also freely drawn upon the publication "Economic Geology of Orissa" prepared by the Officers of the Geological Survey of India I had discussions

regarding mineral deposits in Orissa with Dr J A Dunn, D Sc, the Superintending Geologist and regarding forest products with J W Nicholson, Esq, C I E, I F S, the Conservator of Forests for Orissa During the course of this enquiry I visited some of the important industrial undertakings in the Province and had discussions with the District Officers and a number of prominent public men interested in industries and in the industrial development of the Province It has been a pleasure and privilege to have the benefit of their experience and valuable suggestions I am grateful to all these gentlemen for their help and co-operation

CUTTACK
The 15th March 1945

H B MOHANTY

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INTRODUCTION

Orissa has not developed industrially as some of the other provinces of India have The few industries that the Province has at present are a paper mill, two sugar mills, a glass factory, a soap works, a few oil mills and a number of rice mills She is fairly rich in potential resources for the development of heavy, medium, small scale and cottage industries But most of these industrial resources have hitherto been lying idle They have not so far received the attention of the industrialists which they deserve The reasons for this are many It is worthwhile in this connection to recall a talk I had some years ago with one of the prominent industrialists of India, which will help to focus attention on one of the most essential requirements for the development of industries He had made a decent contribution to relieve the distress caused by a heavy flood in Orissa and when I asked him why does he not put up a factory in Orissa to give permanent relief to the poor labourers instead of giving out occasional doles for flood reliefs, he told me that in locating a factory an industrialist has to look to four important items, viz , raw material, power, labour, and market Our discussion was regarding the Cement Industry and he said "Raw materials you have some, your labour is cheap but mostly unskilled, your power resources are not yet developed and there is hardly sufficient market to consume the greater part of the output of a factory It would be difficult to locate a factory at a place which does not provide a major part of these four essential requirements' He told me then that the greatest need for Orissa was to seek out and develop her power resources If she can provide cheap power industries by themselves will come gravitating down to Orissa like her rivers seeking their way down to the sea There will be no need then to persuade the industrialists to come to Orissa As an example he pointed out to me how the Lonavla Hydro Electric Scheme changed Bombay from a great business to a great industrial centre and made the cotton mills of Surat to move away to Bombay, because of the cheap power available there This shows that the provision of cheap power is an essential preliminary to any scheme of industrialisation in the Province

For the development of industries the essential requirements are (1) raw materials, (2) fuel and power, (3) easy communication or transport facilities, (4) markets, (5) money, and (6) men The requirements of individual industries have been discussed separately in the chapters that follow It would not probably be out of place here to give a general picture of the position in Orissa regarding each of the essential requirements stated above

1. Raw materials

The chief sources from which industries in Orissa can draw their raw materials may be classified as (i) geological or mineral resources, (ii) forest resources, (iii) agricultural resources including vegetable and animal products, and (iv) marine resources Few of the provinces in India possess all of these sources and Orissa is particularly fortunate in possessing all the four of them though each one of them is not as rich as it elsewhere is.

(i) *Mineral resources*—So far as the mineral resources of Orissa are known, it would not be possible for Orissa to attain a high degree of industrialisation based upon her mineral wealth as would be possible for the neighbouring Province of Bihar The mineral deposits known so far are not many and most of them are not easily accessible But it must be said at the same time that geologically Orissa is one of the least known regions of India and apart from a detailed mapping in selected areas geological information about the greater part of the Province is only broad in outline and relates to the general distribution of the principal rock groups It is for this reason that in the past Orissa has been regarded as a region lacking in useful minerals. That is why the big industrial concerns did not pay any attention so long to Orissa It was only in 1939 that a systematic geological survey of the Province began The recent findings of limestone, graphite, china clay, iron ore and manganese deposits have helped to dispel the prevailing gloom and have made the future

more bright and hopeful So far only a preliminary survey has been made based on the reported mineral occurrences It might, therefore, be expected that a detailed geological mapping will bring to light other occurrences of value While hoping for better and bigger mineral findings in future, if we take stock of the present we find that except for china clay and refractory materials which are more or less distributed throughout the Province the deposits of limestone, graphite, manganese and iron ore are confined to the high lands of the Sambalpur and Koraput districts Of these the limestone and iron ore deposits are not easily accessible at present So the exploitations of these minerals will have to wait till better communication facilities become available It would, however, be possible at present to utilise the fire clay and china clay deposits in making refractories, potteries, ceramics and glass, the graphite deposits in making crucibles and other graphite products and manganese ores in making steel and ferro manganese The limestone and iron ore deposits of Koraput are richer but they are far removed from coal It is, therefore, to be expected that the industries based on iron ore and limestone such as iron smelting steel refining and cement manufacture will develop earlier in Sambalpur than in the Koraput district The position, however, may change when cheap hydro electric power becomes available in the Koraput district

(ii) *Forest resources*—As regards the forest wealth of Orissa, timber is the major product and it is being increasingly extracted and exported—the chief consumer being the Railways Only a minor part of it is used locally for structural purposes and for making packing cases and furniture The forests could easily supply enough material for starting saw milling, plywood and possibly match industry in Orissa Bamboo which comes next in importance to timber and sabai grass are being increasingly used for paper manufacture Here again the major part is exported to the paper mills in Bengal Only the bamboo from the Sambalpur forests is being utilised for manufacturing paper in the Province The production of wood charcoal is done on a small scale but wood distillation is unknown Due to scarcity of coal in certain areas, Orissa will have to turn more and more to wood charcoal to meet her requirements of fuel for industrial purposes Some of the minor forest products such as mohua flowers and myrobalans are at present only partially utilised The forests of Orissa together with those of the Orissa States could provide valuable materials for the distillation, tanning, soap and oil industries

(iii) *Agricultural resources*—Orissa is mainly an agricultural province but the cultivation of economic crops like sugarcane, jute and tobacco has not received enough attention At present there are three sugar mills in the Province of which one is a small concern Of the two bigger mills one has gone out of production and the remaining one is only half fed for want of sufficient quantities of cane There is urgent need to increase cane production in Orissa All the jute produced in the Province is exported though there seems to be ample field for a jute mill Tobacco curing on modern lines is unknown and the oil mills have to depend upon imports from outside to meet their full requirements The Province is particularly deficient in oil production It would, therefore, be very desirable to expand the production of money crops, so that the future development of industries in Orissa which is mainly an agricultural Province may be broad based on agriculture

So far as the animal products are concerned the Province exports a large number of hides and skins Except a few minor tanning establishments there is no modern tannery worth the name in the Province Dairy farms and sheep rearing for wool have yet to develop The other cattle products like hoofs and bones are mostly wasted while only a part of the horns is utilised by the horn industry which is chiefly located at Cuttack and Parlakhemedi

(iv) *Marine resources*—The marine resources of the Province consisting of mineral biological and plant products have only been partially developed till now. There have been some sporadic efforts to manufacture salt but the quantity produced is rather small and not enough to meet even the requirements of the Province Fishing is mainly confined to inland waters and the foreshore, and deep-sea fishing has not till now received any attention The Province is well

situated for the development of fisheries and therein lies the possibility of a great industrial development The weeds of the Chilka Lake are capable of yielding the valuable culture media agar agar which together with the nux-vomica and hundreds of other medicinal plants and herbs found in Orissa could lead to the establishment of a biological products and pharmaceutical industry in Orissa

Orissa is not rich in minerals So it would be better for her to turn her attention increasingly to salt—the so called mineral of the sea In fact Orissa's chief hope of industrialisation lies in utilising the products of the sea The manufacture of salt and recovery of the by products would in itself constitute a big industry But the thing on which Orissa ought to concentrate all her energy is the development of industries such as the manufacture of alkalies and bleaching agents, etc , which are based on salt These industries belong to the heavy chemical group and *the heavy chemical industry is the industry for Orissa* Thus the utilisation of the mineral, biological and plant products of the sea holds enormous possibilities of industrial development for Orissa People from all over India come to Puri on the sea in Orissa to seek spiritual salvation It would, therefore, be in fitness of things for Orissa *to turn to the sea for her* economic salvation which she could find by developing industries based on the valuable and limitless resources of the sea

2. Fuel and power

(1) *Coal*—Fuel and power are the life blood of industry and without their cheap supply it would be impossible to develop any industry The great industrial countries of the world have been based mainly on coal though the advent of white coal, i e, water power has now greatly changed the situation The development of industries in Bengal and Bihar is in a large measure due to easy availability of coal in those provinces Orissa proper has her coal deposits in the Rampur basin which lies in the district of Sambalpur The Rampur Coalfields yield at present about 45 000 tons of coal a year The ash content of Rampur coal varies from 12 to 13 per cent and its calorific value is about 6,000—7,000 B T U The coal is rich in volatile contents which vary from 31—36 per cent and would be most valuable for distillation and carbonisation purposes The coal is not of metallurgical quality but it has good steam raising properties It is said that the quality of the coal is improving as the pits are being extended in certain directions It is estimated that the Rampur coal bearing area extends over 20 square miles and contains about 100 million tons of fair quality non coking coal *There is likelihood of these reserves being increased* The *Himgir* Rampur Coal Co , Ltd , under the management of Messrs Killick Nixon of Bombay have taken lease of an area of 5 square miles which contains about 10 million tons of coal So *there is considerable room for development in this coal* area Besides the Himgir Rampur Colliery there is another small colliery known as the Ib River Colliery which is just by the side of the Bengal Nagpur Railway line It has sunk *only one shaft and the small raisings of coal are of* an inferior quality with an ash content as high as 30 per cent

Gondwana rocks which are usually coal bearing are found in the Khondmals and Athgarh areas The mapping of these areas may provide valuable information about the occurrence of coal but conclusive evidence can be found only by sinking expensive bore holes. It is a matter for decision by Government whether or not these borings which may prove useful should be undertaken

The greatest disadvantage of Rampur coal for Orissa is that it is not easily accessible to any other district of the Province except Sambalpur These districts have, therefore, to depend for steam coal on the Talcher Coalfield which is easily acce sible and for coking coal on the distant coalfields of Bengal from where the cost of transport is heavy The Talcher Colliery produces fairly good quality coal and the deposit is estimated at 200 million tons The use of Rampur coal in the coastal districts of Orissa and in Koraput for industrial purposes will have to wait till *the Sambalpur branch of the Bengal* Nagur Railway gets joined to the Talcher branch on one side and the Raipur Vizianagram branch on the other

In the absence of coal supplies there is the possibility of wood fuel, charcoal and producer gas being utilised for industrial purposes in some areas where fire wood is plentiful Wood fuel with a producer gas plant is being used with a fair amount of success by the glass works at Baraag After a careful considera tion of cost it has been found that it would be possible to use wood fuel to run the proposed paper mill at Motu in Malkangiri taluk of the district of Koraput which is far away from any coalfield and is not at present accessible by rail The need for coal in Malkangiri taluk for a paper mill at Motu, a cement factory at Kottimeta and an iron works at Umerkot is very great How far these demands can be met by wood fuel or charcoal is a matter for careful considera tion The possibility of production of power alcohol for industrial purposes by using mohua flower or molasses is there but the quantities of raw material available do not seem to be enough This can at best meet only a minor frac tion of the power requirements of the Province It would be better to utilise this alcohol for preparing fine chemicals and medicinal products than to utilise it for power purposes

(ii) *Electricity*—There are at present four public supply companies at Cuttack, Berhampur, Puri and Balasore and two industrial concerns namely, the Sugar Mill at Rayagada and the Paper Mill at Brajarajnagar which generate electric power The public supply companies supply power for industrial purposes to some small industrial concerns and there are as many as thirty private installations and small mills which generate electric power for their own use either for industrial or lighting purposes The energy available for indus trial purposes from the public supply companies is limited in quantity and due to its generation from oil the cost is high It is, therefore, urgently necessary to develop other power sources in order that really cheap power may be available in the Province for industrial development

The Province has many hydro electric power possibilities Of these the two largest ones are the Duduma Fall on the Sileru river and the Bogra Fall on the Kolab river both in the Jeypore estate in the Koraput district In addition to these two falls there are a large number of smaller falls in the Province The damming of the rivers at suitable sites could also provide water not only for irrigation but also for power generation purposes It is estimated that 70,000 K W will be available from the Duduma Fall and 72,000 K W. from the Bogra Fall At present no large industries exist within 50 miles of the site It is, therefore, proposed to develop these power schemes by stages and to carry the transmission lines to Sambalpur district in the north and to Berhampur in the east Thus the power would be available over quite a large area in the Province Unfortunately, however, these hydro electric schemes which have the great advantage of low running cost require high capital expenditure This has stood in the way of their development so far It is, however, to be hoped that these schemes of development will be soon put into operation The above two projects will not be able to supply cheap power to the three districts in North Orissa, viz, Cuttack, Puri and Balasore So for North Orissa, it is contemplated to have a thermal station based on the coal from Talcher This will in a large measure help the development of industries in the very heart of Orissa and will enable a jute mill, a paper mill, a ceramic factory, a saw mill and possibly a textile mill to be erected at or near about Cuttack—the capital of Orissa

Thus both hydro electric and thermal schemes are possible in the Province and it would be a much quicker process to instal the thermal scheme But the development of industries in general and that of the electro chemical and electro metallurgical industries in particular will depend upon how cheaply power can be made available for these purposes It is estimated that the cost of high tension supply from Bogra will be about Rs 130 per K W per annum which is equivalent to 0 7 annas per unit at 34 per cent load factor and that from the thermal scheme 0 75 annas per unit The cost of generation of the thermal project is estimated to be 0 387 annas per unit while that of the Calcutta Electric Supply Corporation is only 0 315 The cost of generation at the Tata Iron and Steel Works is probably still cheaper Bulk supply of power is available to industrial consumers at Mettur at a cost of Rs 60 per K W per year compared to Bogra's estimated cost of Rs 130 and even the supply at Mettur is said to be

three times costlier than what it is in some of the foreign countries which use hydro electric power for industrial purposes The big industrial promoters would like to locate their factories in areas where really cheap power is available near to raw material sources and unless they can find cheap power here they will naturally go elsewhere So Orissa s chance for big industries depends upon the provision of really cheap power which will enable the newly started industries here to hold their own and to compete successfully with the well established industries elsewhere in India and in foreign countries But in any case it is clear that in Orissa electrification must precede industrialisation

3. Transport

Trade and industry cannot develop in a country without proper communication and transport facilities for carrying raw materials to the factories and finished products to the consumers Cheap transport always plays a vital part in the success of industrial enterprises It is, therefore essentially necessary to provide the Province with a good network of roads, railways, water ways and ports The most unfortunate feature of Orissa is that two of her districts, namely, Sambalpur and Koraput which are rich in mineral resources are in comparative isolation from the rest of the Province Opening of roads and railways will greatly help the utilisation of valuable resources lying untapped there An ambitious scheme of road development is at present under the consideration of Government The bridging of the rivers which at present separate the districts and subdivisions of Orissa from one another in the coastal areas should engage the early attention of Government

It has become an urgent necessity to link up the Sambalpur and Talcher branches of the Bengal Nagpur Railway To help industrial developments in the district of Koraput it would be desirable to connect Jeypore on one side with the port of Vizagapatam and on the other with the Rampur Coalfield via the Raipur Vizianagram and Sambalpur lines The question of extension of railway lines to Malkangiri Umerkot and Bastar areas to enable the exploitation of the rich deposits of iron ore and limestone, etc, in those areas will sooner or later come up for consideration It is a pity that the rivers of Orissa being dry for most part of the year cannot be used as water ways If suitable ways could be devised to train them they would be valuable assets instead of being a dreaded menace The reopening of the water route to Calcutta via the Kendrapara canal and the improvements of the ports of Chandbali and Gopalpur will greatly help to develop trade and industries in the coastal districts The organisation of all such transport facilities is a necessary prelude to large scale industrial developments in Orissa

4. Market

Orissa is mainly an agricultural province and as such she has to buy almost all manufactured and consumer goods from outside She has a paper mill but she has to buy paper from outside as the activities of the mill are at present confined to make only kraft paper She has two sugar mills but their production is insufficient to meet the total demand There is enough market for the products of a jute mill and more than one textile and spinning mill could be accommodated in Orissa as has been shown by facts and figures under these industries The products of the glass works are finding good markets outside For the tanning industry there is not only a vast market in India but due to world shortage of leather there is a world wide market open to this industry There would be enough of demand to consume the entire output of a cement factory As for the iron and steel industry and the heavy chemical industry, besides the internal demand there would be an all India market available for the products The internal market for all consumer goods will surely expand with the increase of purchasing power and the consequent rise in the standards of living of the people as a result of the various schemes of post war development So there is not likely to be dearth of market for most of the industries which are likely to be developed in Orissa

5. Money or Capital

Private enterprise plays a great part in the development of industries and ordinarily, therefore, it would be best to leave the establishment of industries

to private enterprise But backward as the Province is in industries, the people have not much direct experience of them They, therefore, look to Government for help and guidance and expect, as in most other matters, Government to take the initiative for industrial development by establishing some large scale basic industries in the Province The people of Orissa being poor it does not seem likely that enough capital would be forthcoming to develop many of the industries for which she offers ample facilities The little capital available in the Province is mostly shy To bring out this capital and to create confidence of the people in industrial undertakings Government participation in some of the industries, specially during the early stages of development, would be a very welcome feature

There is a sharp divergence of opinion in the Province regarding the question whether outside capital should be allowed to play the leading part in establishing industries in Orissa The fear of exploitation in some minds is so great that they would rather leave the development of industries to a later date and wait indefinitely till Oriya capital, enterprise and management is forthcoming to establish them rather than allow the industrial resources to be exploited by outside capital and enterprise But such a policy would, it seems, not only hamper the establishment and growth of industries in the Province but would be suicidal to the interest of the common man and wage earners of the Province whose primary interest is to find lucrative employments in trade and industries no matter how they are financed So the majority opinion is in favour of allowing the establishment of industries in Orissa even with outside capital and management provided Government exercise sufficient control to allow the local people and the local capital, whatever is available, to be associated in these new industrial undertakings Representative opinion is in favour of Government exercising enough control on the industrial concerns to safeguard the interest of the people of Orissa by ensuring that Oriya labour is paid fair wages, educated Oriyas get suitable employments and the Oriya technicians and students get ample facilities for training both in the office and workshop and in the technical processes

6. Men

There would be no dearth of ordinary labour in Orissa as many Oriyas go to Calcutta Jamshedpur and to far off Burma to seek employment Some of these workmen by working for long years in mills and factories have become skilled workers There is, however, a great dearth of technically trained personnel in the Province Oriyas are famous for their craftmanship and they can be easily trained for the various industries The drive for recruitment of war technicians has broken down to some extent the prejudices of the so called educated class against technical training and it is expected that if industries offer good prospects of employment a large number of young men and boys would be forthcoming to receive technical education There would then be the need for a number of institutions to impart the necessary training to these men The proposal to send some thirty young men this year to study various technical subjects in foreign countries has been a very welcome feature and it is expected that some others would be sent for training in institutions in India These men will fill the higher engineering and technical posts in industries and will serve a very useful purpose by helping to train more men to remove the dearth of technically trained personnel in the Province

7. Cottage industries

Cottage industries are of great importance for the economic development of the masses who are employed for only half the time in agriculture The cottage industries generally suffer from lack of organisation, finance and competition from foreign as well as large scale Indian producers The artisans are generally confined to villages and are engaged in supplying the needs of the agricultural population There is need to acquaint them with the modern processes of efficient production and the application of labour saving devices They have to be taught how best to utilise the raw materials and how to cheapen production It is necessary to guide them about the changing tastes and use of alternative raw materials and improved appliances The tools and appliances can be made

available to the workers on a hire purchase system and the cost may be recovered gradually from their earnings If they are to hold their own against competition they have to be trained to make use of scientific progress

The small scale or cottage producer faces serious difficulties in the purchase of raw materials and sale of finished goods besides the difficulties of finance He is mostly a victim of the middleman and financier These can be remedied to a great extent if the cottage workers are organised on a co operative basis and it should be possible for the Co operative Department to come to their help For the War Board requirements these industries were greatly helped on a co-operative basis The Co operative Department supplied the raw materials, gave technical advice, financial help, supervised manufacture and helped in selling the finished products to the Supply Department It ought to be possible to render this help in a systematic manner in peace time to serve the needs of the civil population

8. Industrial laboratory and research

A testing laboratory, a good reference library and some facilities for industrial investigations and research are absolutely necessary in any country that wants to improve its industries Science and research are necessary not only for improvement but also for survival There is always the need for scientific investigation for cheapening production or to enhance the quality of the products, and to discover new kinds of raw material and new uses for by products There is the need for a Department of Applied Science to train men to go out to industry imbued with scientific spirit and well equipped with knowledge to tackle the problems facing industries and to secure efficiency, bigger output and better product

As no such facility for training in Orissa exists at present a beginning could probably be made by adding an industrial science section and library to one of the existing educational institutions in the Province The department should maintain live contact with the industries both big and small that exist in the Province and should try to be in a position to help them out of their difficulties

9. Conclusion

Judging from the number of enquiries received from people from different parts of the Province it seems this survey has aroused their interest People seem to be now thinking more about industries than before Let us hope that this vigorous thinking guided into sound channels with the help and advice of Government will lead to fruitful action It is the general attitude of the public towards industries that determines the degree of industrialisation that a country can achieve The post war plans of industrial development have raised great hopes and have created a favourable public opinion The Province seems to be anxious for a large measure of industrialisation It will be an ample recompense if this preliminary survey helps to give a more definite shape to the plans of Industrialisation of the Province

I. IRON AND STEEL

1. Iron smelting

1 *General*—Iron is the foundation of modern civilization and material progress Steel is made out of iron and centered round the iron and steel industry there are many ancillary industries such as mining, refractory, and flux-making, and associated industries for turning the steel ingots into various structural steels like rails, plates, and sheets and minor steel products like nails, tin plates, corrugated sheets, nuts, and bolts, etc The steel billets turned out by the big steel works are converted by re rolling mills into rods and bars and agricultural implements for rural use By far the biggest producer of steel in India are the Tatas In fact the Tata Iron and Steel Works are one of the biggest steel concerns of the world Their works are situated beyond the Orissa border, and they are dependent for some of their ores and fluxes on the Orissa States The Tatas, and the Steel Corporation of Bengal in North India, and the Mysore Iron and Steel Works in South India are the primary steel producers, i e , they make their pig iron and convert it into steel while there are a number of secondary producers who only convert pig iron and scrap into steel In thinking of an iron and steel industry for Orissa one has to bear in mind the strong competition that this industry will have to face from the well established steel concerns in the neighbouring provinces of Bihar and Bengal as well as the immense deposits of high grade iron ore in Singhbhum, Keonjhar, and Mayurbhanj which are not only cheaply mined but are also easily accessible to them So far as smelting of iron and primary production of steel is concerned it would be better for Orissa to turn her attention to the Mysore Iron and Steel Works at Bhadrabati where the problems are similar to those of Orissa The peculiarity of the Mysore plant is that it uses charcoal instead of coal or coke for smelting iron ore, and converts the iron into steel in electric furnaces It has also a few small electrically driven rolling mills to fabricate the steel for various uses As Orissa is deficient in coking coal and is likely to have plenty of hydro electric power in the near future for the development of her industries it would be best to plan the development of the iron and steel industry in Orissa on the model of the Mysore Iron and Steel Works

Model for the iron industry in Orissa

2 *Raw materials*—Of the raw materials required for the iron and steel industry the primary ones are iron ore coal and water Next comes limestone and fluxes Silica rocks are needed for refractory making and manganese and chrome ores for making steel alloys To make one ton of pig iron nearly two tons of ore, three fourth ton of coke, and half a ton of lime are required In addition 30 tons of water are required to keep the furnace cool Water in the Indian climate is one of the deciding factors for locating steel works Of the auxiliary raw materials, limestone, dolomite, silica rocks and manganese ore are all available in the Province and chrome ore is available in plenty in the neighbouring State of Keonjhar Coal is found in Orissa at Rampur, and at Talcher but the coal is not of sufficiently good quality to be used for metallurgical purposes It will be very costly to bring coal from the Bengal and Bihar coalfields The utilization of charcoal in place of coal would therefore be necessary The reduction of iron ores by charcoal has been practised from very early times, and the Mysore steel industry depends upon wood charcoal for its fuel As very nearly 0 8 tons of coke or charcoal are required to produce one ton of iron, without extensive forests in the neighbourhood it would be difficult to meet this great demand for charcoal But the position as regards fuel and power would very much change for the better when cheap electricity becomes available Electrothermal processes have been applied to the smelting of iron ores, production of ferro alloys, and refining of steel Large scale experiments on the smelting of iron ores and production of ferro alloys by using cheap hydro electric current for power and charcoal as a reducing agent were undertaken in Canada by a commission appointed by Government and it was shown that magnetite ores could be smelted efficiently in the electric furnace although they could not be treated by the usual blast furnace procedure because of their high sulphur content and impurities

The problem of coal

As far as iron ore the chief ingredient for making iron is concerned a high grade iron ore has been found at Hirapur hill near Umarkot (19° 40 82° 15) in the district of Koraput The Hirapur deposit is of high quality but is not comparable in size with the deposits of Singhbhum and Keonjhar Non the less it is large enough to support a small iron smelting industry At Hirapur there is at the lowest estimate, ten million tons of ore whose iron content ranges up to nearly 63 per cent the average being about 60 per cent It is not possible to give a final opinion regarding the extent of this deposit as the entire hill has not been explored Several smaller deposits have also been found scattered all over the district Some of these are used by village blacksmiths for making iron but they can smelt only ores of inferior quality in their little crude furnaces The geology of the Eastern Ghats does not preclude the possibilities of further deposits in the district of Koraput Besides the high grade iron ore, limestone is available to be used as flux, and excellent clays and silica rocks are available for making high quality firebricks for the iron and steel furnaces and manganese is available for making steel alloys and ferro manganese The two bottlenecks however, are the lack of coal and absence of easy means of transport It would be possible to smelt this ore locally for pig iron by means of charcoal, and the forests in the north eastern parts of the district are said to be capable of furnishing an abundance of charcoal for the purpose Thus lack of coal it seems can be made good to a large extent by charcoal So the chief difficulty is one of transport It takes about ten tons of material and stores to make one ton of steel, and because of the mountainous nature of the country the transport difficulties are rather complicated Both the problem of fuel and of transport would be facilitated by providing cheap hydro electric power which will not only work the furnaces to smelt iron and produce steel but also provide cheap transport by operating electric mountain railways or tramways So the establishment of the iron and steel industry depends upon how soon hydro electric power will become available in the locality

Prospect of the industry in Koraput

It is understood that the Bastar State which lies close to the border of Koraput district possesses large deposits of finest quality iron ore The major difficulty here again is also the lack of transport If a railway could be provided connecting Jeypore to the Raipur Vizianagram line it may be possible to take a branch line to Bastar This will make it possible to work these iron deposits with those of Koraput Establishment of large-scale industries and considerable industrial development could be expected by working jointly these vast and rich deposits of iron

Bastar iron ores

A small deposit of iron ore has been found in the Sukinda estate in the district of Cuttack whose iron content is rather high ranging from 66 6 to 69 4 per cent It is difficult to estimate the total quantity of ore available at present This finding raises hopes that in future workable deposits may be found but the Sukinda deposits do not seem to be very extensive

Sukinda ore deposits

The largest quantity of iron ore though of a lower grade is found scattered irregularly over the district of Sambalpur The chief ore reserves are at Akhradand (21° 39 84° 12), Lohakhand (21° 41' 84° 09) Kholgaon (20° 34' 82° 34) and Majhgaon (20° 35 82° 34) It is estimated that nearly fifty million tons of ore containing on an average 55 to 60 per cent of iron are available there scattered over the ten small occurrences which have been examined so far Further discoveries are anticipated during the course of geological mapping Limestone is available in the district to be used as flux and plenty of coal is available at Rampur But the coal is not of coking quality So either charcoal will have to be used or coke will have to be brought from Bihar, and Bengal coal fields But it does not seem likely that the iron and steel industry will develop in the Sambalpur district in the near future because the question of transport of the ore to a suitable site presents a difficult problem, and the Geological Survey of India are of opinion that these low grade deposits are unlikely to be used for iron smelting in view of the rich deposits of Singhbhum and Keonjhar But

Possibility of iron-smelting in Sambalpur

one has to remember in this connection that in England furnaces smelt local ores containing as low as 27 per cent of iron, and some of the best American ores contain on an average less than 55 per cent iron The iron ores of Lorraine worked in France, and in Germany contain only 35 to 45 per cent iron So the Sambalpur deposits containing as much as 55 to 60 per cent iron cannot be rejected as low grade deposits Should hydro electric power or better quality coal from Rampur become available it may be possible to use these ores to make iron and steel to meet the requirements of the country

It is reported that iron ore is found in the Sonepur State The Sonepur deposits will serve as a potential source of supply to the iron industry of Sambalpur when such an industry is established there

Conclusions

Thus both Koraput and Sambalpur seem to hold prospects for the iron smelting industry but both the prospects are somewhat remote Because of the peculiar situation of Koraput far away from any iron and steel works and of the proximity of the vast rich iron ore deposits of Bastar the industry may develop there on a larger scale than in the district of Sambalpur

2 Manufacture of steel

It is not the purpose here to dwell on the technique of steel manufacture but to mention a few facts to stress that steel can be manufactured even without coking coal by using electricity, and to point out what a large part electricity plays these days not only in making steel but also in fabricating it for structural purposes

Advantages of using electricity

Steel is obtained from cast iron by oxidisation in the molten state followed by the addition of carbon and manganese in definite proportions and of some other elements to confer specific properties on the finished metal For the production of steel, the main advantage which has been gained by the employment of electric furnace operation is that a product can be obtained which is equal to the best grade of crucible steel at a considerably lower cost, and on a much larger scale than what is possible with the crucible process The use of electric furnace by enabling the application of high temperatures free from the dust and smoke which are inseparable from coking coal has made possible the close control of chemical composition within narrow limits This has made possible the production of high quality steels and different steel alloys with comparative ease Statistics show that electric steel has practically supplanted crucible steel in America although it has not been so successful in Great Britain Italy which is rich in water power uses electric furnace for producing domestically all her requirements of steel

Demand for steel

Even in India where water power is much less in use, the production of steel by using electric furnace is gradually increasing Before the war the Tata Works had only one electric furnace for converting pig iron into superior quality steels They installed two five ton electric furnaces in 1940 to meet the increased demand for steel The Mysore Works have also introduced two small electric furnaces, and many secondary small producers have started producing steel by using electric plants About a dozen of the re rolling mills which used to roll steel for various structural purposes have become secondary manufacturers of steel of special types by erecting small electric furnaces of their own to meet the urgent and increased war demands which have brought about a great increase in the steel production of India from 750 000 to 1 250 000 tons per annum There is apprehension in certain quarters that as India used to consume about one million tons of steel a year in pre-war days there will be a surplus of about 250 000 tons of steel a year But if the post war plans of development are put into execution it will not at all be a difficult matter to consume this extra production On the other hand the development of new industries, the expansion of the existing ones, and the construction of new bridges buildings and public utility concerns will call for such large quantities of steel that the country will have to face the problem of increasing still more the production of steel The situation can be met by encouraging the production of steel by small producers to meet the vast local demands

Steel manufacture in Orissa

Until such time as Orissa can produce her own iron by smelting the ores available locally she cannot become a primary producer of steel But as soon as cheap electric power becomes available it will no doubt be a great advantage to the Province to set up an electric furnace to produce steel by using pig iron, and scrap bought from main producers, and from big workshops to meet her urgent requirements for constructing bridges buildings, workshops factories, and electric transmission towers for the contemplated grid system By far the largest number of electric furnaces in India as well as in foreign countries are of small capacity, and are meant for melting and utilizing the scrap which gathers in course of ordinary working in big iron mills factories, and railway workshops In pre war days India was producing pig iron of high quality at a comparatively low cost, and was exporting five to six thousand tons of pig iron a year to foreign countries, and was in turn importing about 250,000 tons of steel a year. This shows that there was surplus pig iron available in the country for conversion into steel As a basic industry the importance of steel manufacture is bound to grow as industrialization advances, and it would be worthwhile to set up steel furnaces to produce ordinary steels now by using charcoal, and superior steels when electric power becomes available Thus as a basic industry the question of steel production ought to receive the serious attention of Government

3 Ferro alloys

The ferro alloys are highly important metals, and most of them are electric furnace alloys of iron and carbon plus a third distinguishing metal such as manganese, silicon, chromium, etc Ferro silicon is exclusively an electric furnace product and ferro chromium is also produced chiefly by using electric furnaces these days Ferro silicon is now made in the electric furnaces at Mysore We have yet to import nearly half of our requirements (2,000 tons) from abroad and there are no ferro-chrome furnaces in India There are large deposits of chromium ore in the neighbouring State of Keonjhar but so far these have not been converted into ferro chrome Ferro vanadium is used in certain alloy steels, and high speed steels Vanadium ore exists in the Mayurbhanj State, and a factory has been set up to extract vanadium The production of ferro vanadium may be attempted but the simplest ferro alloy is ferro manganese Manganese is available in the districts of Koraput and Sambalpur close to the Raipur Vizianagram Railway line and detailed information regarding this has been given under the non ferrous metallurgical industries Its principal use is in the manufacture of iron and steel, and about 95 per cent of the world production is consumed in metallurgical industries Manganese steel contains over 7 per cent manganese, and is the toughest material known As it is the simplest ferro alloy a beginning ought to be made in Orissa to make the highly useful steel alloys by making first ferro manganese by using charcoal, or coke brought from outside The manufacture would be greatly helped as soon as cheap electric power becomes available

4 Re rolling mills

Need for a mill in Orissa

There are at present a large number of re rolling mills in India engaged in rolling the scrap collected from railway workshops and the large steel works, and billets purchased from steel makers to make useful steel products Some of the re rolling mills have taken up the manufacture of steel in electric furnaces, and are making special steels in considerable quantities It has been shown before how very necessary it is to increase the number of these secondary producers of steel to meet the large local demands The other class of mills are engaged in working scrap into wires rods, plates, light structurals, angles, bolts, nuts, nails, and agricultural implements Such mills are also needed in the national interest because the demand for such materials in so vast a country as India cannot be met by large producers alone The small mills have a definite place in the steel industry of India, and there is need for putting up at least one such mill in Orissa

5 Bolts and nuts

Bolts nuts and rivets, etc, are essential materials The estimated consumption of these in India is 50 000 tons In spite of increased production nearly half of these are still imported In the post-war period the demand is not likely diminish, and it would be worthwhile to set up a small factory to meet the local demand which will very much increase during the post war period Bolts and nuts are articles of everyday use in workshops and industrial concerns and there will always be need for them

6 Small tools and agricultural implements

Under small tools are included the hand tools such as pick axes, hill hooks, kodalies, hammers, screw drivers, spanners, etc the wood working tools, and the agricultural implements consisting of ploughs, harrows, sugarcane crushers, pans, chaff-cutters etc With various measures for improving agriculture in the country there is likely to be a great demand for agricultural tools and implements To make these not much of plant or machinery is needed. A good foundry, forges, and skilled workmen are needed to turn out these articles in large numbers It would be desirable to increase the number of village forges, and to train the village blacksmiths in the production of new, and improved articles of everyday use for the cultivators There does not seem to be dearth of skill in the village blacksmiths who have been carrying on their ancestral trade and have been meeting successfully the needs of the simple agricultural folk for generations past Some of them make good pen knives scissors, axes, and padlocks But it is difficult for the village blacksmiths to compete with the imported articles mostly because they do not get their requirements of raw materials at cheap rates These difficulties ought to be removed and the village blacksmitb ought to be helped to carry on his ancestral trade so that his services may always be handy to the agriculturist not only for making new implements but also for ready repairs

7 Casting and fabricated steel

It has not been possible to get the quantity of cast-iron articles imported into Orissa but judging from the volume of the trade it is estimated that several hundred tons of articles are imported The chief items of cast material are 'kadhies or frying pans, iron railings rain water pipes and various ornamental parapet fittings By putting up a foundry it would be possible to make all these cast iron articles This will also help to mould many machinery parts and other articles of iron according to design A necessary adjunct of a foundry is a workshop and there is good scope for such a central workshop to meet the requirements of the rice mills, oil and flour mills sugarcane crushers, and other mechanical appliances

Steel trunks, and boxes are being made in increasing quantity in towns like Cuttack and Berhampur The two factories at Cuttack used to buy in normal times steel sheets of various gauges worth about rupees one and a half lakh a year There is a growing demand for these articles and there is room for more factories to make them The factories may be encouraged to make portable steel chairs, and office furniture such as racks and book shelves

8 Steel buttons

Recently some hand pressing machines made locally were exhibited to demonstrate to people how to make nice steel buttons by using waste tin and zinc sheets The manufacture of buttons by using these machines can be carried on as a cottage industry The use of these machines may be popularized by supplying them on easy payment system to the prospective cottage workers

9 Smelting of iron and steel as a cottage industry

The 'Lohares or village blacksmiths have smelted local deposits of iron ore throughout Orissa for centuries past Although imported iron is available cheaply now a days, smelting of iron is still done at some localities chiefly in the inaccessible areas in the hilly tracts of Ganjam and Koraput The 'Lohares'

use mostly soft, and inferior grades of iron ore which cannot be used for iron smelting in the big iron works in India Iron ore is found scattered in small deposits throughout most of the districts of Orissa In the district of Cuttack iron ore is found in Sukinda, and in several localities of Angul In Angul the deposits are small and can only be worked on a small scale by local iron smelters In Puri iron ore is found near Jatia hill on the shore of the Chilka lake, and is used for local smelting In Ganjam iron ore is reported in certain localities such as the Kaladhar Parhat near Kodala and at Bari and Barada in Ghumsur subdivision, and in the Khondmals In Koraput there are people belonging to two castes called "Khati" and "Lohar" who still manufacture some iron by their crude process, and make with it the tools and implements required by the simple village folk The iron ores found in Borasamber, Kolabera Laira, and Rampur zamindaries, and at Barapahar in the Sambalpur district are worked by primitive indigenous methods The Lohars use no flux, and use charcoal which they get from the local forests A decade ago, it is reported, there were 29 such furnaces in Samhalpur, and the number of Lohars was 6,700 The iron produced was used for the manufacture of agricultural implements such as plough shares, hoes, hatchets, and spades The large deposits of iron ore in Samhalpur, and Koraput have already been discussed As they cannot be worked on a large scale until cheap electric power is available, every effort ought to be made to encourage iron smelting by the village 'Lohares' in their small furnaces It may sound absurd to make iron and steel in a village furnace in an age when iron and steel are manufactured in thousands of tons in modern blast and steel furnaces But it may be pointed out in this connection that in the Khondmals the village blacksmiths can even now profitably smelt iron, and make articles which in point of durability can compete with the imported articles Some of the plough shares manufactured over a hundred years ago from the iron bearing materials available locally are still giving excellent service Apparently the 'Lohars' had unknowingly manufactured manganese steel from a mixture of iron, and manganese minerals Manganese steel is of comparatively recent origin, and is produced by modern methods of manufacture If it could be made by a crude process in the village furnaces hundreds of years ago in Orissa it is certainly worthwhile to investigate how best it can be made now in small quantities by the village blacksmiths to meet their local needs, and to encourage such production on a wide scale All the technical help, and materials necessary ought to be given to the village blacksmiths to encourage this cottage production

II. POWER MACHINERY

Steam engines, turbines, generators, crude oil, diesel oil, and petrol engines, alcohol engines

III. ENGINEERING MACHINERY

Transport locomotives and wagons—automobiles—aircraft—ship-building

IV. INDUSTRIAL MACHINERY

For the manufacture of textile, sugar, paper, mining, cement, chemical and electrical machines

V. MACHINE TOOLS—LATHES, DRILLING MACHINES—SHEARING MACHINES.

VI. ENGINEERING INDUSTRIES—LIGHT

Typewriters, accounting machines, calculators, sewing machines, electrical fittings and accessories, air conditioning plant, frigidaires, surgical instruments, bicycles, hosiery machines, match manufacturing machines, etc

None of these industries exists at present in Orissa and unless the Province gets very much industrialised it does not seem likely that any of these industries will be taken up in the Province in the near future

developing the chemical rather than the metallurgical industries So sooner or later it will be necessary to set up a sulphuric acid plant in Orissa which will foster the growth of other industries

2 Salt and alkali industries

The manufacture of alkalies constitutes the most important branch of the heavy chemical industry The consumption of alkalies is an index of the extent of industrialization of a country The Indian chemical industry is very deficient in the manufacture of alkalies India produced hardly any alkali prior to 1940 Some new factories recently started are helping to meet to some extent India's demand estimated at several lakh tons per year The economic production of alkalies will help the development of soap, textile, glass and many other industries Sodium chloride or the ordinary common salt forms the backbone of the alkali industry It will, therefore, be proper to deal first with the manufacture of the basic raw material—common salt, before taking up the manufacture of alkalies

(a) *Salt*

1 *General*—The finest salt was at one time manufactured in Orissa Orissa possesses a vast sea board extending over nearly 250 miles in length Because of the intense tropical heat of the sun most of the areas on the seacoast, and some of the tidal areas in the river estuaries are advantageously situated for the manufacture of salt Salt manufacture was in the past an important industry of Orissa Besides meeting her own requirements, Orissa used to supply salt to the adjoining native States, and the Central Provinces

Present requirements

According to an estimate Orissa needs nearly 10 lakh maunds of salt for her own population, and the adjoining States need about 7 lakh maunds If we add to this the demand from the Central Provinces and that of the alkali industry which it is proposed to develop in the Province it will be evident that there is a great need for the production of salt in Orissa

Centres of manufacture

Salt is being at present manufactured at Huma, Naupada and Sumandi in the district of Ganjam which is the chief centre of production in Orissa The production is about 6 lakh maunds a year Some salt is produced at Inchudi and Talpada in the district of Balasore but the amount produced is small New centres are being opened at Gurbai Tua and Astarang But it needs an efficient organisation to push up the production of salt in the Province, and to organise the industry on modern lines The lay out of the factory, and of the reservoirs and condensers which are of primary importance for the successful manufacture of salt from brine does not seem to have received the proper attention of the organisers of the industry at some of the production centres, and it is no wonder that they have not been able to make much progress though they have been for some time in the field of salt manufacture

Chemical composition

It is said that the brine on the Orissa coast is not rich in salt, and the salt manufactured in Orissa is inferior in quality The composition of brine differs from place to place and as such the salts obtained from different localities differ in chemical composition The table below shows how the salt manufactured near the Chilka lake compares with those manufactured from the sea water at other places —

Sea salt

Locality	Moisture	Insoluble	Sodium chloride	Magnesium chloride	Magnesium sulphate	Calcium sulphate
1	2	3	4	5	6	7
Chilka	7 45	2 8	86 14	2 04	0 04	1 44
Goa	10 8	92	81 85	1 40	0 81	2 16
Canara	5 6	4 52	81 2	1 37	0 73	1 52
Enanore	2t	1 03	88 87	1 83	2 35	0 71
Bombay	3 85	2 a	91 08	0 61	0 03	0 63

2 *By product*—Sea water contains on the average about 3 33 per cent solids which consist of common salt, and a number of other ingredients the most important of which are magnesium chloride sulphate, and bromide, potassium chloride, and calcium sulphate

The average composition of the solids per 1,000 parts by weight of water are as follows —

Sodium chloride	26 0
Magnesium chloride	3 1
Magnesium sulphate	2 2
Calcium sulphate	1 2
Potassium chloride	0 7
Magnesium bromide	0 07

All these chemicals are important items of commerce and industry None of the salt factories in Orissa is at present recovering these valuable by products which are left in the mother liquor after the salt is taken out Nearly 2½ tons of the bittern or the extremely concentrated liquor left after the salt crystallises out is required to manufacture a ton of magnesium sulphate or magnesium chloride which are valuable chemicals Elsewhere in some of the well established Indian salt factories which are well equipped for the recovery of by products it costs something like Rs 40 to Rs 50 to manufacture one ton of these magnesium salts while their present market price is nearly Rs 400 per ton This would show what economic benefits would accrue if efforts were made to organise the manufacture of salt on modern lines and to recover the by products

Value of the by products

The manufacture of salt is at present under the control of the Central Excise and Salt Department of the Government of India But in view of the importance of salt manufacture for the economic upliftment of the Province, it is very much necessary that the Provincial Government should take up with the Central Government the question of organising the manufacture of salt and salt products on a vast scale in the coastal regions of Orissa not only to meet the demands of her own people, and for export but also to supply the important raw material for the early establishment of an alkali industry in Orissa The development of the salt industry on the Orissa coast, and chiefly on the coasts of Ganjam and Puri is likely to yield splendid results This is the one industry that should be pushed through with vigour as manufacture of salt may ultimately form the basis of the heavy chemical industry for the manufacture of alkalies in Orissa

The industry for Orissa

(*b*) *Alkalies*

The manufacture of caustic soda with its by products, and of sodium carbonate or soda ash as it is commonly called constitutes the alkali industry The demand of sodium carbonate for the manufacture of glass, and soap—two of the most important requirements of modern civilization—may be said to have laid the foundation of the heavy chemical industry throughout the world Glass of all kinds contains 10—20 per cent by weight of soda, and the glass and soap industry consume each nearly a quarter of the total world production Alkalies are used in numerous other industries, such as textile, paper, vegetable ghee leather, disinfectants, dyes, and paints, etc It may be said that almost every manufactured commodity has at some stage of production to make use of soda ash or its derivatives That is why the consumption of alkalies is considered as a measure of the state of industrialization of a country

(i) Sodium carbonate

Common salt or brine is the starting material for sodium carbonate as well as for all the alkali salts Sea water contains usually 3—5 per cent solids of which 75—80 per cent is common salt The raw materials required for the manufacture of sodium carbonate by the purely chemical process known as the Solvay or the ammonia soda process are salt solution or brine, ammonia, and carbon dioxide The latter is obtained by burning a mixture of lime, and

coke in the proportion of 7 1 The lime obtained is used in the plant for the recovery of ammonia, and practically the whole of ammonia is recovered, and used again and again So that is not a consumed raw material The ultimate raw materials, therefore, are salt and limestone For every hundred tons of the finished product 95 tons of lime or 122 tons of limestone and 175 tons of salt are consumed with 15 tons of coke Common salt or brine is available in plenty on the coast of Orissa, and it would he possible to use charcoal in place of coal

There is a gap at present of nearly 266,000 tons between production and consumption of sodium carbonate in India which has to be filled up by the installation of new plants A medium size plant of capacity say 12 000 to 15,000 tons could be erected on the Orissa coast to meet the needs of the adjoining regions It would be best to locate the factory at a place where the railway line runs close to the sea so that easy transport facilities may be available for the transport of the finished product as well as for the raw materials such as lime to be brought from within the Province and coke from outside the Province Such sites are available in the district of Balasore and in the Ganjam Puri border The latter region would be preferable because electricity is likely to be available there cheaply in future When cheap electricity becomes available it will lead to further developments indicated below

( ) Caustic soda

Sodium carbonate is largely used for conversion to caustic soda by treatment with lime as it is the caustic soda for which there is a huge direct demand from soap, vegetable ghee, textile, and paper industries But caustic soda can be obtained directly from brine by the electrolytic process The success of the process however depends upon the availability of cheap electric power, and is naturally favoured by the existence of water power The electrolysis of brine liberates both chlorine and hydrogen with the direct formation of sodium hydroxide or caustic soda It is found profitable to burn the hydrogen produced in the chlorine to obtain very pure hydrochloric acid which finds many uses in the chemical industry Hydrogen can be used also for producing ammonia which is a very valuable product and in the oxy hydrogen flame for welding and cutting metals Chlorine is used for manufacturing hydrochloric acid, chlorites, and bleaching powder or is liquified and sold in that form At the present time the world's requirement of chlorine is far from equivalent to the enormous amount of caustic soda consumed by the industries So the scope of the electrolytic process is somewhat limited by the extent to which its by product chlorine can be utilised because the dangerous nature of the gas makes it impossible to get rid of it like the other by product hydrogen by simply allowing it to escape into the air in any inhabited locality

The electrolytic process has an enormous advantage over the older process in that caustic soda is produced by this process in one operation whereas the older methods produce only the carbonate or the bicarbonate So as soon as cheap electricity becomes available it would be far more desirable to erect a plant for the manufacture of caustic soda than one for sodium carbonate because in case of the latter the chief by product calcium chloride has hardly any market value while in case of the former both the by products—hydrogen and chlorine—can be profitably utilised The small demand for sodium carbonate for washing, and other purposes can be met by converting caustic soda into sodium carbonate by utilising the gas carbon dioxide obtained by burning limestone to get the lime required for making bleaching powder Thus everyone of the by products can be utilised by following the electrolytic process of manufacture

The large scale consumers of caustic soda are the soap textile, and the paper industries Another important consumer is the artificial silk industry which consumes nearly one third or more of the total world output Of the small scale consumers the important ones are oil refining and the vegetable ghee industries The latter is of great national importance as it helps to supply to a large extent the deficiency of fats in our diet which primarily consists of starch and is lacking particularly in proteins and fats The present production of alkalies in India is

only a fraction of the country s total requirements More than 80 per cent of India's total requirements estimated at 50,000 tons is being filled by imports Thus there is ample room for expansion, and the demand is likely to be greater as the country gets more and more industrialized During the post war period it may be necessary to erect 4 or 5 plants in India each with a capacity of 8,000 to 10,000 tons per annum, and their location will obviously be governed by the availability of cheap electric power Whether Orissa will be able to contribute her full share to this scheme of making India self sufficient in respect of her requirements of alkalies depends upon how quickly the various schemes of electrification at present under the consideration of Government can be put into effect Alkali manufacture is the industry on which Orissa should concentrate her efforts and there seems to be no reason why this industry cannot be developed successfully in Orissa

3 Bleaching Agents

Bleaching powder and chlorine—The chief source of world s chlorine supply is the electrolytic alkali industry in which it is obtained as a by product For every 10 tons of caustic soda we get nearly 9 tons of chlorine which can be converted into nearly 25 tons of bleaching powder The principal outlet for chlorine was the manufacture of bleaching powder by combining it with lime Bleaching powder is used in large quantities in paper, and pulp industries It is al o used in textile mills and to some exteut for sanitat on and public health purposes The increase in paper production in India or the establishment of new paper mills for which there are definite scopes in Orissa, will lead to increased consumption of bleaching powder The present tendency is to use liquid chlorine instead of bleaching powder as there are certain advantages in using chlorine alone free from the lime present in the bleaching powder So liquid chlorine is now taking the place of bleaching powder It is an ideal disinfectant and is used to sterilize drinking water Its use can effectively help to bring down the death rate from typhoid There is a great need for it in Orissa to free her from the typhoid menace Application of chlorine in sewage in cities is very much on the increase Both liquid chlorine and bleaching powder are used in large quantities in refining crude oil. Chlorine is used for the manufacture of hydro chloric acid, chloroform and a number of organic solvents In fact the organic chemical chemistry is very much dependent on chlorine for the manufacture of dyes insecticides, fire extinguishing liquids, anaesthetics, etc In other words chlorine is the basis of the fine chemical, and pharmaceutical industries But it is only a by product of the alkali industry So the establishment of an alkali industry which carries with it so many possibilities, will help al o the growth of a pharmaceutical industry in Orissa

4 Fertilizers

Closely allied to the heavy chemical industry is the manufacture of chemical or artificial fertilizers The use of artificial fertilizers at the present time is on so large a scale that several million tons of these materials are consumed each year Plants require for their food certain nitrogen compounds and mineral salts the chief of which are the salts of phosphorus and potassium Orissa soils are very poor in nitrogen and phosphorus content due to want of proper manuring and the washing away of the soil by heavy rainfall and frequent floods The quantity of fertilizers used in Orissa which may be taken as the same as that for India is negligible being 61 lbs per acre compared to 233 lbs used in a country like Egypt The result has been our yield of crops is very poor Taking rice which is our chief crop as an example we find there is a big disparity between our yield of 830 lbs per acre to China s 2 300 lbs Our yield is generally 4—5 times poorer than what it is in other rice producing advanced countries of the world The total cultivated area in the Province is reported to be 6 828 000 acres If Orissa is to develop her agriculture she will need nearly 7 million maunds of fertilizer a. the rate of even one mauud per acre But the quantity recommended to be used per acre is still higher So this shows how huge is our requirement of fertilizers

The three main groups of fertilizers are those containing combined nitrogen, potassium, and phosphorus respectively Lime is also used but this is mostly to counteract acidity in the soil rather than as a fertilizer in the strict sense

(a) Nitrogen fertilizers

(i) *Ammonium Sulphate*– There are two groups of nitrogen fertilizers—the organic, and the inorganic group The chief inorganic fertilizers are the ammonium sulphate and calcium cyanamide Ammonium sulphate was obtained formerly almost entirely as a by product of the dry distillation of coal in gas works, and coke ovens It is made these days also by the synthetic process As far as the synthetic production of ammonium sulphate is concerned, it would be needless to consider here the possibilities of its manufacture as the matter has been separately under the consideration of Government The Foodgrains Policy Committee of the Government of India have come to the conclusion that at least 350 000 tons of ammonium sulphate a year should be made available for increasing the foodcrops in the country and the Hon ble Supply Member has taken up the question of production of ammonium sulphate in the country by importing the necessary machinery from abroad One such plant will be set up in Bihar to meet the requirements of the Eastern Zone Orissa will probably get her requirements of ammonium sulphate from Bihar Whether it will be possible for Orissa to obtain ammonium sulphate as a by product of the coal distillation industry depends upon the setting up of a plant for distilling the Rampur coal which is rich in volatile matter But to supply a balanced food to the plant it is necessary to provide other fertilizers besides ammonium sulphate which has certain deleterious effects on soils, and specially on sandy soils which are abundant on the deltaic regions of Orissa These soils are also generally deficient in lime It is, therefore necessary to consider here the possibility of manufacturing in Orissa other fertilizers to supplement the supply that she will get from outside sources

(ii) *Calcium cyanamide*—Calcium cyanamide has assumed importance as a fertilizer since the discovery of its economic production in the electric furnace It appears that for soils which are not rich in humus and are deficient in lime, calcium cyanamide is almost as good as ammonium sulphate Calcium cyanamide or 'nitrolime' as it is commonly called is obtained on a commercial scale by heating a mixture of calcium carbide and coke to about 1000 ° C in a current of nitrogen Since calcium carbide is manufactured almost entirely in the electric furnace, the process can only be carried out where electricity can be generated at a very low cost So the possibilities of production of this type of fertilizer should not be lost sight of when cheap electricity becomes available in Orissa This product has been found to possess the advantages of cheapness and of supplying the much needed calcium to soils

(iii) *Organic fertilizers*—Broadly speaking any animal or vegetable matter can be used as manure As it will take some years to develop the power resources in Orissa which will enable the cheap production of artificial fertilizers it would be best to enhance the production of natural fertilizers to meet the immediate growing demand *This can be met to a large extent by encouraging* the cultivation of oil seeds which will supply not only oil for the soap, paint, and vegetable ghee industries but also oil cakes for cattle food and agricultural purposes Compost making would be another valuable source of supply Fish and meat guanoes are prepared from fish and meat waste or from fish and meat unsaleable as human food Fish guano has 8—10 per cent nitrogen, 4 5—9 per cent phosphorus oxide, and 1 per cent potassium oxide while oil cakes have 5 per cent nitrogen, 2 per cent phosphorus oxide and one per cent potassium oxide Thus fish guano is an excellent plant food The carcass of dead animals would be a valuable source of supply of meat guano When fish curing and canning develops as a large scale industry in Orissa it will be a valuable source of supply of fish guano

(b) Potassium fertilizers

The need of potash salts for sandy soils of the coastal tracts is great But as potassium bearing rocks are rare in Orissa the potash requirements of the soil will have to be met by using farm yard manure sea weeds and the ash obtained by burning wood as a fuel for domestic as well as for industrial purposes The recovery of the potassium salts from the bittern of the salt works would meet the need to a great extent But the salt works in Orissa do not recover any by product at present The spent liquor of the alcoholic fermentation and distillation industry is rich in potassium salt, and would be a valuable source of manure The liquor instead of being allowed to run to waste, as is the case at present, ought to be put to proper use

(c) *Phosphate fertilizers*

It has been found that the use of phosphates greatly increases the yield of all crops and particularly of paddy. Best results are obtained by using mixed manures containing nitrogen and phosphorus. About two thirds of the total fertilizers used in the United States of America consist of phosphates and the total amount of phosphatic manures used is over five million tons a year. Next comes organic nitrogen group of which tankage, i e, the recovery from sewage tanks is 700,000 tons. Cotton seed and oil cakes 280,000 tons and fish carp 260,000 tons. Mineral nitrogen group under which comes ammonium sulphate is only 143,000 tons. Vast quantities of limestone finely ground are also used. This gives an idea of the relative importance of the different types of manure used in one of the most advanced countries of the world where soil conditions are somewhat akin to ours, and shows how great is our need for phosphatic group of fertilizers in comparison to the other groups.

The chief phosphatic manures are the super phosphates, and various bone manures. Super phosphates are usually prepared by the action of sulphuric acid on calcium phosphate which is the chief constituent of rock phosphates. No information is available regarding the location, and extent of the phosphatic rocks in Orissa. It would, therefore, be desirable to make a systematic survey of such rock deposits. But the production of super phosphates is dependent upon the availability of sulphuric acid which is not available at present in Orissa. So the only alternative source left to us at present is the large quantity of bone available in Orissa. It is gathered that at present about 60,000 maunds of bone is exported from Orissa. But the quantity actually available is considerable, and it is not being properly utilised. Bone manures are prepared by first treating the raw bone with chemicals to extract the organic materials which would be valuable for glue making, and then by crushing the bones into fine powder in power driven crushers. There is a great need for a bone mill in Orissa, and every effort ought to be made to put up one as soon as possible.

5 Liquid Gases

For the development of the fish industry in Orissa there is a great need for cold storage plants and refrigerating devices. For this purpose it is necessary to have liquid ammonia or dry ice, i e, solid carbon-dioxide. It has been shown under caustic soda manufacture that the by product hydrogen can be converted into ammonia by combining it with atmospheric nitrogen. A special plant would be necessary to produce ammonia, and unless the industry for manufacturing ammonium fertilizers develops, there does not seem to be any possibility of producing ammonia for refrigeration purposes. It would be easier to obtain carbon-dioxide either from the fermentation tanks of the distilleries or by calcining lime. The gas can be compressed into cylinders, and used for making aerated waters or by cooling and further compression can be converted into dry ice. But unless the Province gets sufficiently industrialised there does not seem to be much prospect of these minor industries developing in the near future.

B. Fine Chemicals

There are as many as 4,000 different varieties of chemicals in use at present which are called fine chemicals because they are used in small quantities compared to the heavy chemicals. These chemicals are of vital importance to industries especially the drugs and pharmaceutical industry. War has necessitated the manufacture of many drugs, and medicines in India from indigenous raw materials. But before the war India depended on imports for the major portion of her drugs, and medicines as she was deficient in the production of essential oils, alcoholic extracts, biological products, and solvents such as chloroform, benzene, and ether. The fine chemical and drugs industry in India, generally speaking is in a rather undeveloped state. The products, of coal and wood distillation form the chief foundation for the manufacture of fine chemicals. But so far, the distillation of coal and wood in India, and the recovery of the by products have not received much attention. Consequently the raw materials for the production of fine chemicals are lacking in India. Every effort ought to be made to make up the deficiency by encouraging the distillation of wood and coal in India which are important industries in other advanced countries of the world.

1 Wood Distillation

1 Wood is the earliest fuel employed by man for purposes of warmth and cooking In Orissa it is mostly used as fuel for cooking It is seldom realised that it is a source of valuable products like methyl alcohol acetic acid acetone tar, and wood charcoal Wood charcoal is free from sulphur, and leaves little ash when burnt, and thus possesses special advantages for metallurgical purposes The present shortage of petrol and the extensive use of producer gas plant has created a great demand for wood charcoal Wood charcoal is made in some of the forest areas of Orissa by following a rather primitive method The wood is built into stacks and is set alight The heat developed by the combustion of a part of the wood serves to carbonize the remainder The extent of the combustion is limited by preventing the access of air by covering the burning stack with earth In the modern method of making charcoal the wood is heated in retorts and this procedure makes possible the recovery of certain valuable volatile products The non condensable gases evolved are used to heat the retorts, and are just sufficient for the purpose Good air dried wood yields 25—30 per cent charcoal 5—10 per cent tar, and 45—55 per cent liquid distillate known by the name of "wood vinegar" which contains acetic acid (10 per cent) methyl alcohol (2 per cent) acetone (0 5 per cent) and many other aliphatic substances as well as some tar To show how important each of these products is for modern industrial purposes brief notes on the uses of some of the important products are given below

(i) *Methyl alcohol*—By distillation of the wood vinegar methyl alcohol is obtained which is used in denaturing ethyl alcohol to make methylated spirit It is also used as a solvent for resins in making varnishes and French polishes It is the chief source of all synthetic methyl compounds used in industries One of the most important derivatives of methyl alcohol is formaldehyde It is used for making plastic glues used in plywood industry and also for making bakelite powder in combination with phenol which is a product of coal tar distillation

(ii) *Acetic acid*—This is the organic acid which gives vinegar its sharp taste The commercial acetic acid is obtained in considerable quantity by the destructive distillation of wood, and the hard woods yield 4 7 to 6 5 per cent concentrated acid It is used in the manufacture of metallic acetates which are used as mordants in dyeing Lead acetate or white lead, and copper acetate are used extensively in the paint industry Glacial acetic acid is used in many synthetic products, and in the preparation of cellulose acetates used in manufacturing artificial silk For this purpose it is produced in Canada cheaply from acetylene gas generated from calcium carbide The possibility of manufacturing calcium carbide in Orissa when cheap electric power becomes available has been discussed elsewhere

The demand for vinegar is gradually increasing, and the local people are developing a taste for it It can be made by fermenting dilute alcoholic liquors such as the juice of date and palm trees Vinegar of an inferior quality is being made at present at some places in Orissa from 'toddy' But the people ought to be taught more modern and efficient methods of converting 'toddy' into vinegar so that a more hygenic product suitable not only for cooking purposes but also for table use can be obtained There is ample field in Orissa for encouraging the production of vinegar on a large scale as a village industry specially in the areas where date and palm trees are found in plenty

(iii) *Acetone*—Acetone is present in the crude wood spirit from which it is separated by distillation It has very useful solvent properties and can dissolve considerable quantities of acetylene gas It is used extensively as a solvent in the manufacture of smokeless powder or cordite from nitro cellulose, and nitro glycerine, and in the manufacture of artificial silk On account of its valuable properties as a solvent, and as an organic re agent it is prepared on a large scale by using acetic acid

2 From the foregoing it will be clear how important the wood distillation products are for modern industrial purposes As Orissa has not got any deposit of coking coal she will have to depend on charcoal as a substitute for coke for many industrial purposes Fortunately she is rich in forests where fire wood is abundant After the big tree trunks are cut and converted into timber the branches, and tree tops are left to waste in the forests They can be usefully

employed not only to make charcoal but by subjecting them to destructive distillation it would be possible to get the valuable by products mentioned above which will supply material for many industrial products At present the Barang Glass Works is using more than three hundred maunds of wood a day As the supply position becomes easier the factory is anxious to expand its production, and expects to consume about thousand maunds of wood a day The proprietor is anxious to recover, if it can be arranged the by products from the huge quantity of wood that the factory would be consuming There is at present only one wood distillation plant in India attached to the Mysore Iron and Steel Works It would be worthwhile to investigate further the possibility of starting a wood distillation plant at Barang or in some other favourable locality where the supply of fuel wood is cheap and abundant In Orissa there are extensive forests and attempts ought to be made to derive the maximum benefit by using the waste wood of the forests for valuable industrial purposes

2 Coal Distillation

Coal has been the most important industrial fuel from the time of introduction of machinery By far the greater part of power for industries is supplied by boilers consuming coal But by this wasteful method the valuable by products contained in coals are uselessly lost The anthracite coals which are rich in carbon burn without much smoke and flame as they are poor in volatile contents Orissa does not possess any anthracite coal The coal deposits in and near Orissa at Rampur and Talcher can be classed as bituminous coals Their carbon content is lower but they yield more volatile matter and burn with a bright smoky flame This coal is not good for metallurgical purposes but has got good steam raising property By low temperature carbonization of such coal a part of the volatile matter can be expelled leaving sufficient of it behind to give a bright but clean flame Ammonia tar and gas can be obtained as distillation products without impairing the usefulness of the coal to be used as fuel industrially for raising steam The tar obtained by the low carbonization process does not yield hydro carbons like the tar obtained from high temperature carbonization High temperature carbonization of coal is done either in the coke ovens or in the gas works The tar obtained is a valuable source of material for the organic chemical industries, and yields benzene, toluene, aniline, naphthalene phenols and creosote etc From these are produced most valuable products such as drugs, dyes, disinfectants essences, and explosives Coal tar is distilled in India by the Bengal Chemical and Pharmaceutical Works and a few other concerns to recover creosote naphtha, and some other products The Rampur coal is rich in volatile matter and the volatile content varies from 31 6 to 33 6 per cent Such coal would be good for distillation purposes and would yield valuable products In industrially advanced countries coal which is rich in volatile contents is highly valued for the substances it yields on distillation It is only by distilling coal and coal tar and by recovering the valuable by products some of which are important chemicals, that a solid foundation can be laid in a country for the drugs and dye industry or the fine chemical industry Orissa s chance of industrialisation lies in her trying to develop the heavy chemical industries It would, therefore be quite in line for her to try to develop the fine chemical industries as well She cannot use her coal for metallurgical purposes She might as well try to make the best use of her coal resources for chemical purposes for which they seem to be well suited

3 Alums

Alums are largely in demand for purification of water supplies for sizing paper and for dyeing and printing of cotton textiles They are also used in water proofing cloth and for coagulating colloidal substances in sewage Commercial alum is made from china clay or bauxite by digesting the aluminium containing materials in sulphuric acid Elsewhere has been discussed the desirability of putting up a plant in Orissa for manufacturing sulphuric acid When sulphuric acid becomes available with china clay available in the Province and fairly good quality bauxite available in the Kharnar plateau and the neighbouring State of Kalahandi it would be possible to manufacture alums in Orissa Large quantities of alum or the commercial prodact alam ferric are likely to be required for clarifying water supplies of suspended impurities when such facilities are provided in all towns in Orissa in the the post war period With the increased production of paper the demand for which will continue to increase with the

spread of education, large quantities of alum will be needed by paper mills for sizing paper As the demand for printed textile increases the textile trade will consume more and more alum It is estimated that annually about 22,000 tons of alum will be required No special plant or machinery would be required for the purpose But it would be necessary to train a few men in the technique of making the chemical The availability of sulphuric acid is, however, the deciding factor for starting the manufacture of these aluminium salts

4 Bichromates

Bichromates are used industrially in the production of dyes, yellow and green pigments for the paint industry, in electro plating and tin plating, and in anodising aluminium surfaces to make them hard like steel The alkali bichromates find extensive application as mordants in dyeing, especially for khaki dyeing They are also used in large quantities for chrome tanning of leather A huge quantity of hides and skins is exported from Orissa There is a definite field in Orissa for the tanning industry This will provide a market near at hand for bichromates if they could be produced locally The paint industry is also likely to consume some of the product, and electroplating, and anodising of aluminium both of which require bichromates are likely to develop when hydro electric power becomes available So there will be need for bichromates in increasing quantity in the Province

The raw materials required for manufacturing sodium bichromate are chrome ore, soda ash, lime, and sulphuric acid Good quality chrome ore is available in plenty in the neighbouring State of Keonjhar Lime is available in the Province, and if the heavy chemical industry develops both soda ash, and sulphuric acid would also be available At present chrome ore is exported to foreign countries, and bichromates are imported It seems, therefore, that by utilising the chrome ore locally it would be possible to manufacture bichromates cheaply to compete successfully with the imported product, and to make India self sufficient as regards her bichromate requirements

5 Medicinal products

(i) *Quinine*—The cultivation of cinchona plants is being tried in the Jeypore estate in the district of Koraput, and something like a thousand trees have been planted as an experimental measure The Forest Department of the estate is trying to increase the area under plantation By the older process the plants were allowed over five years to mature before extraction of quinine from their barks could be taken up The new Russian experiment of extracting quinine from one year old cinchona trees ought to be given a trial as India's requirement of quinine is very much greater than the present production Considering the wide prevalence of malaria, and its injurious effects upon the people, the question of increasing the production of quinine is an urgent one If the experiment of growing cinchona trees in the Koraput district proves to be a success, it might be possible for the Province to get all the quinine she needs within her own boundaries

(ii) *Strychnine*—Strychnine is an alkaloid which is extracted from the seeds of nux vomica which grows abundantly in many parts of Orissa It grows also in the neighbouring States All the nux vomica grown in Orissa, and the Orissa States are exported The exact quantity of nux vomica exported is not known but the quantity exported is certainly great It would be highly desirable to set up the necessary plant to extract the strychnine locally instead of sending the nux vomica outside There would be need for scientific skill to extract the product and to determine its strength before offering it for sale

(iii) *Shark liver oil*—Due to the war when cod liver oil became scarce in the market there arose the need for finding out a substitute in its place That is how shark liver oil came to be used for medicinal purposes Cod liver oil contains both vitamin A and D Shark liver oil contains little vitamin D but it contains 8—15 times more vitamin A than cod liver oil By diluting shark liver oil with a good quality edible oil such as the groundnut oil, and by compounding with suitable quantities of vitamin D from a source like ergosterol, a product is found which has been demonstrated to be as efficacious as cod liver oil To increase its usefulness still further it can be compounded also with the concentrated juice or extract of ' Amla " (Phyllanthus emblica) fruit which is available in large quantities in Orissa forests

Thus there is a fair prospect of finding enough market for the shark liver oil The Fisheries Department of the Government of Orissa prepared last year, as an experiment, more than 100 gallons of shark liver oil from the sharks caught off the Orissa coast, and found that it would be possible to prepare the oil on a commercial, scale and, market the product at a reasonable price to compete with cod liver oil Thus the possibility of the industry has already been demonstrated It needs now business organisation to run it on proper commercial lines The only thing wanting at present is that there is no facility in Orissa to test the vitamin potency of the oil and as such the oil has to be sold as a raw material When the industry develops on a large scale further benefits will accrue by utilising the by-products such as shark skins and flesh It has been found that shark skins after suitable treatment, yield a fine soft leather suitable for making hand bags, and fish glue can be made out of shark flesh

(iv) *Agar agar*—Agar agar is a vegetable product resembling gelatine, and is used mainly as a culture medium for bacteria Agar agar is of essential necessity to biological institutions, and is used in the manufacture of vaccines, and particularly of cholera vaccine During the war the supply of agar from foreign countries has been cut off, and there is now a great demand for the product There is a good possibility of manufacturing agar in Orissa as one of the sea weeds Gracilaria Lichenoides that yield agar, grows abundantly in the Chilka Lake It is understood that from the few tons of the weed supplied as a sample to the medical division of the Supply Directorate, several million doses of the cholera vaccine have been prepared, and the Chilka weed has been found to be richer in agar than the other samples examined by them It seems, therefore, that it would be quite possible to set up a factory near the Chilka Lake to extract the agar agar and to manufacture therefrom the various vaccines, and biological products This will serve as the nucleus of a pharmaceutical, and biological industry in Orissa But in order to ensure a constant supply of the weed for a long time to come a thorough study of the life history of the weed ought to be undertaken The time when the plant breeds, and the stage of development at which its agar content is highest should be determined so that the plant would be collected only during this stage and a close season would be observed during the breeding period There would be need for technical skill to extract scientifically the agar medium from the sea weeds, and to prepare and standardize the various biological products prepared with it The Provincial Bacteriological and Pathological Laboratory may be of some help in providing the necessary technical skill, and the matter is well worth further investigation The establishment of the industry ought to receive every encouragement from the Government as the manufacture of agar will provide a great incentive to manufacture vaccines, and biological products Thus along with the extraction of strychnine, and manufacture of shark liver oil will provide a good nucleus for building up a drugs and pharmaceutical industry in Orissa

(v) *Indigenous medicinal plants*—Chadei Gudi (*Vitex peduncularis*) and Sunari (*Cassia berina and fistula*) grow wild in many parts of Orissa. The bark of both these is invaluable for treatment of blackwater fever and is a first class diuretic drug Chiretta (*Andrographis paniculata*), Vasaka (*Adhatoda vasica*), Asoka (*Polyalthia longifolia*) and Datura (*Datura fastuosa*) are all found in abundance in Orissa No attempt has been made so far to extract their active principle for medicinal use When a chemical and pharmaceutical industry is started in Orissa, the innumerable herbs, and medicinal plants found in plenty in Orissa will provide valuable raw materials for preparing syrups, alcoholic extracts and tinctures, etc

6 Scents and perfumes

Flowers and scented materials of different kinds are available for making scented oils and waters in the Province The materials available are Kia or Keoda (*Pandanus fortidus*), Champak (*Michelia champaca*), Bakul (*Mimusops elengi*) and Nageswar (*Ochrocarpus longifolius*) flowers, and Khas Khas (*Andropogon muricatus*) roots. There are some centres in Parikud, Gopalpur, and Chatrapur in the district of Ganjam where several thousands of Kia flower are used for making scents and scented water The average production cost of the Keoda essence is reported to be Rs 10 per lb while the selling price is above Rs 30 Bakul and Champak scents are manufactured at Satyabadi, Cuttack, and Jajpur Scent from Nageswar also is manufactured at Jajpur Keoda water is in demand in many towns and the industry needs suitable organisation for the production

and proper marketing of these scents The root of the plant Bena is known as Khas khas The root is used mostly for making screens to keep out heat during summer It grows abundantly in the river beds in Orissa The scent is extracted from the root

7 Miscellaneous chemical products

(1) *Resin oil (Chua oil)*—The oil is prepared by distilling the resin of the Sal tree (*Shorea robusta*) by a crude indigenous process The industry is a specia lity of the town of Cuttack, and a large quantity of Chua oil is exported to Madras, Calcutta, and other places Formerly it was used as a scent but is now used mostly for flavouring tobacco for chewing purposes By using improved methods of manufacture it was found by the Poor Industries Cottage that the yield could be considerably increased There seems to be a good demand for the product in Orissa as well as from outside

(2) *Catechu*—There are catechu trees in the Angul forest and in many places in the Koraput and Sambalpur districts The substance is manufactured by boiling the wood of the tree cut to small pieces, and then by thickening the juice Catechu is used in hotels, and also for dyeing purposes The catechu imported from the Central Provinces fetches a better price as it is refined It would be necessary to get a few workers trained in the Central Provinces in better methods of manufacture to improve the quality of the product which can then fetch a better price

(3) *Ink*—The manufacture of inks is one of the minor industries essential to modern life Ordinary writing ink is made from iron salts and tannic or gallic acid Myrobalans which are a good source of tannin, and are found abundantly in Orissa can serve as a valuable ingredient for ink manufacture Ink is made by mixing the water extract of the myrobalans containing the acid with ferrous sulphate, a soluble dye, and a little phenol as preservative Writing ink is now being made by one of the small local chemical concerns The industry deserves encouragement as ink is an article of everyday use for the educated man and there is always a good demand for the product

8 The minor chemical works in Orissa

Attempts have been made in the past to organise chemical works in Orissa to manufacture articles of everyday use such as inks phenyl, washing soaps, hair oils, cosmetics, etc The Prachi Chemical Works and the Orissa Chemical Works put into the market some fine products After doing well for a time all of them sank into oblivion The Prachi unbreakable slates were a nice product, and had once a good demand from outside markets The process of manufacture was developed, and patented by one of the laboratory assistants of the Raven shaw College But the production has ceased due to scarcity in the market of cardboards, and other ingredients used in the manufacture. It would be desirable to revive the manufacture, and recover the lost market

At present the Bhagat Chemical Works at Cuttack, the Co operative Home Industries Ltd , at Berhampur and one or two similar small concerns at other places are trying to make some useful articles to meet the present heavy demand in the market The inks and disinfectants manufactured by the Bhagat Chemical Works seem to compare favourably in price, and quality with similar products in the market Government might encourage the growth of such industries by patronising their products

VIII CELLULOSE INDUSTRIES

A. Paper

1 Existing industry—The Orient Paper Mill at Brajarajnagar in the district of Sambalpur is one of the most important industrial concerns in the Province At present it is engaged in making kraft paper, and cardboards It gets its supply of bamboo from the forests in the Sambalpur district, and some of the Orissa States as well as from the neighbouring areas in the Central Provinces

It gets its requirements of fuel from the Rampur Collieries which are nearby Supply of labour is adequate *The mill employs* about 1,500 permanent and 1,000 temporary hands besides 2,000—3,000 persons engaged in extracting and transporting bamboo from the forests *Most of the labourers* are Oriyas but there is hardly any Oriya in the higher and technical staff The mill ought to provide

ample facilities for the training and employment of educated Oriya young men Many Science graduates would be willing to have practical training in paper technology if suitable facilities for proper training could be provided by the management of the paper mill The production at present is about 1,000 tons a month Additional machinery for doubling the present production capacity of the mill has been ordered in America The proprietors of the mill are also considering the possibilities of manufacturing artificial silk using the cellulose obtained from bamboo pulp

2 *Raw materials*—The raw materials for paper making are —

(i) Primary materials—Bamboo, sabai grass, rags, jute, and waste gunny bags

(ii) Auxiliary materials—Lime, china clay, rosin alum caustic soda, bleaching powder, and dyes

Bamboo is now accepted by the paper industry as an excellent material for the production of various kinds of paper Next to bamboo, sabai grass is the second important raw material used by Indian paper mills for the manufacture of paper pulp There are extensive bamboo forests in Orissa and the neighbouring States and sabai grass is also available in considerable quantities There are possibilities of extending the cultivation of both these materials on an increased scale to ensure a plentiful supply of the basic raw material for the manufacture of paper on an extensive scale in Orissa Thus there seems to be good prospects for putting up one or two more paper mills at suitable places in the Province

3 *Markets*—There need be no apprehension for finding market in India for the increased paper production With the growth of trade and industry, and specially of mass literacy and education there will be enormous demand for paper India is at present one of the poorest consumers of paper in the world, for instance the consumption of paper per head of population in Britain is said to be nearly 100 lbs a year whereas in India it is less than 1 lb The existing paper mills in India are unable to meet the demand, and India has to import a large quantity of paper, and the whole of her requirements of newsprints from foreign countries Thus it will be seen that there is need for putting up more paper mills in India and it would be distinctly advantageous to locate these mills at places where the raw materials can be had cheaply, and in plenty for a good many years to come

4 *Future prospects*—Cuttack, situated as it is on the railway line and at the head of the Mahanadi delta is a natural outlet for the bamboos extracted from the forests lying on both banks of the Mahanadi and her tributaries The Indian Tariff Board after examining the various available sites for the expansion of the paper industry in India had selected Cuttack and Saharanpur as the two best sites offering exceptional facilities The essential requirements of a paper mill, such as, a continuous supply of bamboo—the basic raw material, availability of coal plenty of cheap labour, abundance of fresh water, and easy water and rail transport facilities are all admirably fulfilled at Cuttack The exceptional position of Cuttack for the paper industry was pointed out by the Tariff Board some years ago but this splendid opportunity instead of being availed of, seems to have been allowed with lapse of time to slip out of hand The bamboo areas in Orissa Government forests in the Angul subdivision have been leased out on a long term basis to the Titagarh Paper Mills who are now extracting the bamboos on an increasing scale to meet the present great demand for paper They are also taking on lease the bamboo areas of the States bordering on the Mahanadi So the chances of getting bamboo for a paper mill at Cuttack are getting gradually less and less In fact the Conservator of Forests is of opinion that it will not be possible to get the required quantity of bamboo and sabai grass at Cuttack for the establishment of a good sized paper mill so long as the existing leases continue But in the interest of the economic regeneration, and industrial development of the Province the possibility of having a paper mill at Cuttack ought to be thoroughly investigated before being given up as impracticable for want of raw materials

When I visited Gunupur which is the terminus of the Parlakimedi Railway, some of the leading businessmen there seemed anxious to find out the possibilities of putting up a paper mill there Gunupur seems to possess certain advantages in this respect It is not only a railway terminus but is also situated on the river Bansadhara More than 26 000 maunds of sabai grass are being sent out annually at present to the Titagarh Paper Mills from the Gunupur station, and it is reported that dense bamboo forests lie on the banks of the river up stream But the extent of the bamboo forests and of, supplies of sabai grass and fuel resources need careful investigation before anything definite can be said about the possibility of having a paper mill at Gunupur

The Jeypore Samasthanam has taken keen interest in exploring the possibilities of establishing a paper factory in the Jeypore estate, and with that object in view they had a survey made in 1939 of the prospect of paper manufacture at Motu in Malkangiri taluk The site selected for the mill is situated at the junction of the Sileru and Sabari rivers which would provide easy water ways for transport of both raw materials and the finished products The present position in this respect will be changed greatly when Jeypore gets connected by rail to the Vizagapatam harbour The bamboo areas chosen for exploitation are easily accessible by road and river from the proposed mill site The site which lies at one of the extreme corners of Orissa is accessible by road but it is nearly 200 miles away from the nearest railway station

The area of the forest chosen for bamboo extraction is 40 sq miles in extent, and is situated on the banks of the Sileru river Of the 40 sq miles or 25,600 acres it is estimated that the effective bamboo area is about 12,000 acres The total standing crop of bamboo on the 12,000 acres was estimated to be 75,000 tons On the assumption that a three-year felling cycle will be adopted the sustained annual yield would be about 25 000 tons or more than double the quantity required for a 4,000-ton paper mill Thus the supply of bamboo exceeds the potential demand to such an extent that no shortage of supplies need be anticipated for long years to come provided the forests are exploited under a settled scientific working plan Moreover, there are other important areas of dense bamboo forests at a distance of about 60 miles from the proposed mill site The yield from these areas will probably enable the proposed 4,000 ton mill to be extended to four times its initial capacity

The success of an industrial undertaking depends not only on cheap supply of raw materials but also on easy transport facilities, and cheap power or fuel resources In an industrial undertaking of this nature transport is the most important costs item specially when the raw materials to be handled are heavy, and the mill site is so far away from any railway For a 4,000 ton paper mill, the quantity of raw materials such as wood pulp, rags, and waste papers, and of chemicals such as bleaching powder, caustic soda, soda ash, rosin, china-clay, alum, and lime required will be approximately 6,000 tons To this must be added the product of the mills, i e, 4,000 tons of paper, and if coal is to be used for fuel a further 12,000 tons So the total weight of imported and exported materials without taking into account the 10,000 tons of bamboo required for the mill will be about 22,000 tons per annum By using wood fuel in place of coal, and hydro electric power from the falls on the Sileru river, if and when it becomes available, the burden of transport can be greatly reduced After the Jeypore Vizagapatam line is opened up it will be sooner or later necessary to extend the rail line to Malkangiri taluk, and then to Bastar for the exploitation of the rich mineral and forest resources of that part of the country for important industrial purposes But for the time being, the mill will have to depend for its transport facilities on the Sileru river which will link up the factory through the Godavari with Rajahmundry. Thus Rajahmundry will serve as the railhead for the factory The proposed site on the Sileru river besides providing easy access to the raw materials, and transport facilities will provide the enormous quantity of water required by the mill It is estimated that about 60,000 gallons of water are required for every ton of paper Of the auxiliary raw materials lime is likely to be found within a reasonable distance from the mill site China clay is available in the district and the alkali minerals will be available if an alkali industry develops in the Province.

The question of fuel for any factory in this area far away from any coalfield requires most careful consideration Due to enormous cost of transport of coal, the only alternative available at present is wood fuel Wood can be used as a substitute for boiler fuel, and it is gathered that suitable boilers can be designed for the purpose But as the calorific value of air dry wood is only 4 500 B T U i e , about 40 per cent of that of coal nearly 30 000 tons of wood fuel will be required per annum in place of 12 000 tons of coal For the required quantity of firewood about 9 square miles of forest will have to be exploited annually and it is understood that the necessary forest area is available well within 10 miles of the site So the question of fuel does not seem to be an insurmountable difficulty The above considerations show that it would be possible to erect a paper mill and manufacture paper at a competitive price at Matu although it is far away from railways and coal mines It needs now initiative and industrial enterprise to translate these industrial possibilities into real achievements and thereby raise the economic level of the Province

5 Cottage industry—Due to the shortage of paper hand made paper is now being made at a number of places to meet the great demand in the market to some extent The main varieties of paper produced are blotting filter, and writing paper But the quality of hand made paper is uncertain and it is difficult to get uniformity of texture and colour It requires a good deal of technical skill to improve the quality Hand made paper is finding a ready market now because of the prevailing scarcity of mill made paper But when things return to normal again, it would be very difficult for hand made paper to hold its own in face of the severe competition from mill made paper

B Rayons

It has already been mentioned that the Orient Paper Mill proposes to take up after the termination of the war, the manufacture of artificial silk by utilising the cellulose from bamboo pulp It is not known whether bamboo pulp would be suitable for the purpose or not The quality and finish of artificial silk depends on the nature of the material used The cellulose materials primarily used for making artificial silk are cotton lint and rags cotton waste, and wood pulp In India at least 10 000 tons of cotton waste is obtained every year from the ginning machines It is a problem to dispose of this material. Experiments have been made to turn it into purified cellulose which with acetic acid can be manufactured into artificial silk. The other chemicals required are sodium hydroxide bleaching powder sulphuric and nitric acids Orissa has not got the primary cellulose materials used for the manufacture of artificial silk in foreign countries where the technique is very much advanced. The processes involved in the manufacture are highly technical and require the use of both heavy and fine chemicals. So until and unless the chemical industries develop there is no prospect for the artificial silk industry in Orissa

C. Plastics

1 Shellac

1 Lac culture in Orissa—The chief natural plastic substance found in the Province is shellac It is formed as a secretion by insects feeding on certain trees The resinous secretion in its raw state is known ordinarily as lac Lac grows on cultivated lands in the district of Sambalpur and in the Bhadrak subdivision of Balasore district and on Kusum (*Schleichera trijuga*) and Khair trees (*Acacia catechu*) which are common in certain types of waste lands and jungles in the Sambalpur and Koraput districts The cultivation of lac was tried in Sambalpur and the experiments have shown that it would be possible to cultivate lac in that area But due to the extreme heat of the place the mortality of the insects in the hot weather is heavy and so the cultivation cannot be as successful as it is in Chotanagpur and Singhbhum

Lac can be grown more successfully in the Koraput district where it is not so hot in the summer as it is in the Sambalpur district The chief Kusum

area is confined to Umarkote Nowrangpur, and the Kalahandi border Previously more than 3 000 maunds of lac used to be collected by the Jeypore estate per year At present the production has gone down As lac is a valuable product its cultivation in all areas where Palasa and Kusum trees abound, ought to be encouraged on a large scale

2 *Its uses*—The resinous secretion obtained from the trees is separated from the twigs and is then ground and washed with water The substance in this state is called lac Lac is the principal ingredient of sealing wax and forms the basis of valuable varnishes and furniture polish In fact its principal use in India is for polishing furniture It is also used for making bangles and lac quering wooden toys pen holders and sticks etc But these can absorb only a limited quantity of lac Its principal use in the industry is for making insulating varnish and moulding compositions for electrical insulators and for making gramophone records Tha gramophone industry consumes more than 60 per cent of the world s output of shellac

3 *Cottage industry*—Some of the lac grown in the Jeypore estate in the district of Koraput is made into sealing wax but most of it is exported Sealing wax can be easily moulded from lac by women and children Its manufacture could therefore, be introduced as a cottage industry but its scope is extremely limited At present Orissa sells her lac and buys all the furniture polish she needs A large number of people in the town of Cuttack are engaged in making furniture and they require a fairly large quantity of furniture polish By encouraging the production of denatured or methylated spirit in the distilleries in the Province, the lac exported at present could be made into furniture polish, and Orissa would not have to depend on supplies from outside

Lac is used by the weavers of Berhampur, and Sambalpur for dyeing the silk they weave This produces a fine deep red colour but with the decline of the silk industry the art of making this fine red dye from lac is also dying out

The principal use of lac for cottage industry purposes is in making bangles which are used by women of certain castes in Orissa Bangles are universally used at the time of marriage in Orissa Lac bangles are made chiefly in the Cuttack town, Nowrangpur and Umarkot in the Koraput district, Thakurpatna in Kendrapara Kathnapatna in Jagatsinghpur, Purunabazar and Pithol in Ganjam, and in many other places The use of these lac bangles is falling into disfavour as they are rather thick and are somewhat crude in design compared to the fancy glass bangles So the manufacture of lac bangles in improved and modern artistic designs ought to be introduced in order to enable the industry to recapture its lost markets, and to cut down the imports from foreign markets

2 Resins gums and glues

1 *Resin*—Resin is a sticky substance exuded in brown gummy drops from trees Resin is mainly obtained in Orissa from the Sal trees (*Shoren Robusta*) which grow in abundance in all forests It is burnt as an incense in temples and homes as it gives out a sweet smell and is believed to purify the air Whether the fumes have any germicidal property or not is not known but it certainly helps to drive away mosquitoes Some resin is used in the town of Cuttack for making Chua or resin oil for which there is a good demand But the chief use of resin is for making varnishes of which it is an important constituent The exact quantity of resin available from the Orissa forests is not known but an idea of it can be made from the fact that the Jeypore Samasthanam alone gets an annual revenue of Rs 20 000 from the resin collected from the estate forests So the quantity available in Orissa must be considerable But very little of the huge quantity of resin available in Orissa is being put to use in the Province as the art of giving wooden and metallic articles a resin polish and the process of making resin varnishes are unknown There is a huge demand for resin from the paper industry as it is used for sizing paper It would be worthwhile to investigate how to treat the resin available in Orissa so that it can be used in the paper industry Thereby a valuable market could be found for the product

2 *Gums and glues*—Gums and glues as distinguished from resins are soluble in water But like resins they are either exudations or dried saps of trees Glues unlike gums which are vegetable products, are animal products and have stronger adhesive properties than gums Gums and glues are used for various purposes in homes, offices, and industries They are used for bookbinding, wood joining, plywood, furniture and shoe-making etc The chief gum-bearing trees found in Orissa are Babul, Asan, Kaitha, Amhada, Dha, etc These trees grow in abundance but very little of the valuable gum they yield is collected

At present no glue is made in Orissa though the carpenters, toy makers, and shoe makers use a considerable quantity of glue The scrapings of leather from tanneries, the refuse of shoe makers' shops, and the flesh of dead animals are used for making glue But the Chamars, Pans, and Doms who flay these dead animals for their skin do not know how to make glue If arrangement could be made by getting a few men from Cawnpore where they make glue, to teach some people in Orissa the process of making glue, a large quantity of glue could be manufactured in the Province The scrap from slaughter houses such as the skins, ears, tails, and tendons of slaughtered animals are made into hide glue, and bone glue is prepared from raw bones which yield 12—15 per cent glue As Orissa exports several thousand maunds of bone a year, a huge quantity of glue could be recovered As the fish and shark liver oil industries develop, it will also be possible to make fish glue by using the flesh of sharks, and the fish that are unfit for human consumption Thus there are possibilities for producing large quantities of glue in the Province from waste animal matter which can be sold profitably in outside markets India imports Rs 5 lakhs worth of glue a year And as industries grow the demand would be still greater As casein glue is not found in plenty in India, the use of animal glue is getting popular for plywood manufacture A plywood factory has been started recently at Cuttack So a market could easily be found at hand for the animal glue if it were manufactured in Orissa

IX. SUGAR AND ALCOHOL

A. Sugar

1 Cane sugar

1 *Existing industry*—There are altogether three sugar mills in the Province (1) The Charchika Sugar Mills at Banki, (2) the Aska Sugar Factory at Aska, and (3) The Jeypore Sugar Company's Factory at Rayagiada Of these the Charchika Sugar Mill is a very small concern, and produces only a small quantity of sugar by centrifusing the jaggery produced locally Banki is said to be a good area for growing sugarcane, and it would be possible for the sugar mill to develop by pushing up the acreage under cane in the locality Every effort should, therefore, be made by the Agricultural Department to encourage the cultivation of sugarcane in that area, and thereby help the Province to make up her deficiency of sugar production

The Sugar Factory at Aska is situated in a good cane growing area, and due to the efforts of the local Cane Growers Co operative Society the area under sugarcane is increasing from year to year But it is unfortunate that the factory has ceased production this year, and is not likely to resume production in the immediate future As the local cane growers have been put to difficulty by the factory going out of production some of the prominent men of the locality are thinking of setting up a new factory if Government could help them to get the necessary machinery The machinery of the existing sugar factory at Aska is rather old, and the factory works the diffusion process for extracting sugar from cane while most of the modern factories use crushers to press out the sugar containing juice from cane From a cursory look at the plant, it seemed that the factory could probably be modernized by replacing the diffusion plant by cane crushers as the rest of the plant such as concentration pans, crystallizers, and centrifuges are just like those used in modern factories Anyway it is a matter for the proprietors of the factory to decide what they want to do with their old plant But considering the large and growing area under sugarcane at Aska, it is in the

interest of the cultivators that every effort should be made either to modernize the existing factory or to set up a new one there There is definitely the need for a sugar factory as Aska

The Sugar Factory at Rayaghada was established in the year 1937 The plant is considered to be modern and is operated by steam, and electric power generated by using bagasse supplemented by wood fuel The plant is capable of crushing 400 tons of cane per day But for want of adequate supply of cane it cannot crush at present more than 200 tons The factory is dependent on the adjoining Madras areas to the extent of about 35 per cent of its present requirement of cane The factory is at present producing approximately 75 000 maunds of sugar annually In the post war period the management expects to push up the production to 100 000 maunds For this it would be necessary to bring sufficient area under cane cultivation Owing to the apathy of the local cultivators who belong mostly to hill tribes the efforts made by the local Cane Growers Co operative Society to extend cane cultivation has not succeeded Government help is needed to induce by propaganda or otherwise, the local cultivators to grow more cane or to sell or make available to the Cane Growers Co operative Society enough waste land in the area on terms of long lease Great improvement could be effected and better varieties of cane could be grown in that area if irrigation facilities could be provided The possibility of having a small irrigation project for that area may be investigated When electricity becomes available it would no doubt be easier to arrange for irrigation by putting up an electrically driven plant on the river that passes through the cane-growing areas

The company need the assistance of Government in securing the following machinery and equipment for the factory —

(1) One Babcock and Wilcox Boiler of 4 000 sq ft heating surface with all necessary mountings

(2) Six sugar mill rollers of size 20 dia ×36 plain

(3) Three Worthington Simpson Type Duplex Pumps with necessary fittings having capacity to deliver 90 G M P

(4) Four Isolating Switches of 400 volts and 400 amps capacity

(5) One Generating Set as a stand by

2 *Future prospects*—Orissa does not produce enough sugar to meet her own needs In 1941-42 she imported 97,700 maunds of gur and 232 300 maunds of sugar The total area under sugarcane in 1942-43 is reported to be 33 660 acres The quantity of sugarcane produced from an acre of land depends upon the soil quality of cane quantity of fertilizers used and several other factors In India an acre on an average yields 12 6 tons of cane This yield is certainly poor compared to Java s 55 tons per acre The yield in parts of Hawaian Islands is even still higher This shows how much room there is for improving our methods of cane cultivation The average percentage of sugar in canes in Bihar and the United Provinces during the period 1938—43 was found to vary from 9 14 to 9 87 The Rayaghada sugarcane yields on an average 9 5 per cent sugar The yield may be considered to be good in view of the fact that there are no irrigation facilities and only the dry varieties of cane are grown there Much better results could be achieved by providing irrigation facilities to enable better varieties of cane to be grown To get an idea of the quantity of sugar produced in Orissa we may take the average yield to be 12 6 tons of cane per acre and the sugar content 9 5 per cent The total yield comes to approximately 40 000 tons In most of the civilized countries of the world the consumption of sugar per head of population varies from half to one cwt per annum Taking the lower figure of half cwt the requirements of Orissa with a population of 8 73 millions comes to 218 000 tons Even taking the minimum of 2 oz of sugar per head per day for a balanced diet, Orissa s annual requirement comes to 175 000 tons

of which she produces only 40 000 tons So to provide the minimum requirement of sugar for her people, Orissa ought to increase her sugarcane cultivation by more than four times There would then be room for many more sugar mills in Orissa

The expansion of the existing mills has already been discussed As regards the possibility of putting up new ones there seems to be immediate scope for a mill at Gunupur Plenty of sugarcane can be had within a radius of twenty miles and ryots are said to be willing to cultivate more cane when a factory is put up in that locality The land near Gunupur is fertile and the river Ranasdharn flows nearby Gunupur being a railway terminus, does not lack transport facilities The molasses which will be obtained as by product will be utilised by the local distillery which for want of molasses utilises at present the costly stuff gur or jaggery So the place seems to possess good facilities for a sugar mill.

3 *By products*—The by products of the sugar industry are (*a*) molasses, (*b*) filter cake and (*c*) bagasse or the crushed cane In Orissa all the molasses produced is being utilised by distilleries for making liquors When more molasses becomes available it might be utilised for making rectified spirit or neutral which would be greatly in demand for making artificial silk The filter cakes are valuable fertilizers and they ought to be used as such As regards bagasse, it was so long being used as fuel in the mills But it has been found out that it can be made into press boards for which there is a demand these days These boards can be used in future for sound insulation purposes The factory at Rayaghada proposes to take up the manufacture of these boards It needs Government help to secure the necessary plant and building materials for the factory

2 Confectionery

A small factory has recently been erected at Rayaghada to make lozenges, toffees and other sweets Its production capacity would be about 750 maunds a month There is a demand for these articles and their production ought to be encouraged

3 Date sugar

As the Province is deficient in sugar, it is desirable to tap alternative sources of sugar to make up for this deficiency There are a number of date and palm trees Some of the date trees are tapped for toddy but the palm trees are hardly tapped The juice of both these plants can be used for making 'gur'. It is being manufactured in small quantities in North Balasore The process ought to be encouraged in all parts of the Province where date and palm trees can be found in numbers It is necessary, however, to demonstrate to the people how to make 'gur from these juices The palm gur or rather the sugar candy prepared out of it, is said to possess medicinal properties, and so it sells usually at a fairly high price

B Alcohol

1 *General*—There are a number of distilleries mostly in South Orissa the chief of which are the distilleries at Aska, Gunupur, Rayaghada and Jeypore They are all at present busy in making country liquor as there is a great demand these days for wines In Sambalpur open stills for making country liquor are in vogue One such still at Dhanupalli is fitted with a rectifying apparatus It is making rectified spirit or alcohol and is converting it into denatured spirit and foreign varieties of wines such as rum, and brandy The Kapuguda Central Distillery at Gunupur has already got the rectifying apparatus as it had plans to make power alcohol using mohua flower as base, but as all its distilling vats are fully engaged at present in supplying the demand for country liquor, it has not been able till now to manufacture power alcohol The sugar factory at Rayaghada has also plans for making alcohol for industrial purposes by using its own molasses as soon as the necessary permits and plants can be secured.

2 *Raw materials*—To manufacture alcohol we require cheap sugar containing materials The chief raw materials used in Orissa are molasses, jaggery, and mohua flower (*Bassia latifolia*) Molasses is obtained as a waste product of sugar manufacture, and mohua flower is found abundantly in the jungles of Orissa Large quantities of mohua flower are sent out of Orissa and could be usefully utilised to make alcohol in Orissa But its supply is at times irregular due to failure of the crop in some years These sugar containing materials are fermented and distilled to produce what is commonly known as country liquor To make pure alcohol, further distillation is carried out in stills fitted with rectifying columns It is only by successive distillation that the product is made free from water, and rectified spirit or alcohol is obtained

3 *Uses of alcohol*—Apart from its use as a beverage, alcohol or to put it more correctly ethyl alcohol has a wide range of uses in various industries, and its production can therefore be regarded as a basic industry. It is the most widely used solvent next to water, and enters into the manufacture of medicines, tinctures, anaesthetics, dyes paints, varnishes, lacquers and explosives It is used for the manufacture of acetic acid or vinegar chloroform, and ether, and is indispensable for the preparation of pure chemicals Alcohol, like petrol, can be used as a motor fuel but it cannot be used very efficiently in modern vehicles Provided it can be manufactured cheaply it can be used successfully by mixing with petrol, and can therefore serve as a valuable addition to petrol when petrol supplies become insufficient

4 *Market*—The war has created a great demand for alcohol, and the use of power alcohol as a motor fuel has been coming gradually into use for supplementing the supply of petrol The Hyderabad State has erected a factory to produce power alcohol from mohua flower The possibility of erecting such a plant to manufacture industrial alcohol by using the mohua flower available in abundance in the forests of Orissa, and of the adjoining States may be further investigated The use of alcohol in greater quantities in the post war period will depend upon the progress of industrialisation, and there is likely to be large demand for new lines of production If the manufacture of drugs and medicines and of furniture polish develops in Orissa there will be need for plenty of alcohol Even without this the external demand for alcohol is so great that there is not likely to be any dearth of market if this new line of manufacture develops on a large scale in Orissa

X. GLASS, REFRACTORIES, CERAMIC AND CEMENT

A. Glass

1 *Existing Industries*—There is only one glass factory now working in Orissa known as the 'Sree Durga Glass Works" It is situated at Barang, a railway station on the Bengal Nagpur Railway next to Cuttack towards the south The construction of another glass factory is going on at the next station Mancheswar but the factory has not yet started production The factory at Barang makes lantern globes, chimneys, bottles, phials, jars, jugs, and drinking glasses But the glass produced is not of high quality. For want of coal the factory is at present using wood fuel to fire the glass melting and annealing furnaces But the producer gas plant used is not able to raise the melting furnace to a sufficiently high temperature Consequently the products are not free from inclusions of air bubbles The working processes employed for making hollowware are all manual So the bottles manufactured are of a poor finish, and are irregular in shape To get better uniformity, and make the bottles suitable for mechanical closing a semi automatic machine of the type used in some of the factories in the United Provinces would be necessary To ensure a good degree of mechanical strength in the products it would also be necessary to arrange for a better continuous process of annealing than the crude process adopted at present The factory gets almost all its raw materials from outside It gets its requirements of sand from Allahabad, lime from Katni, and soda from Imperial Chemical Industries It uses a certain quantity of quartz, and sand stone available at Kalapathar, and fireclay at Jagannathaprasad—places which are not far from Barang The labour, and technical

personnel employed except two or three head blowers are all local men The factory wants to expand its production as soon as the supply position becomes easier, and coal and chemicals become available in sufficient quantity But to produce good quality glass it would be necessary to employ a properly qualified glass technologist The factory has not tried to use any of the river sands available in plenty nearby Properly sieved fine grained sands ought to be quite suitable for the inferior types of glass the factory is producing at present, but such sands would need higher temperatures for fusion The factory would be well advised to try the local sands, and the sand stones available at Naraj and other places and thereby save the heavy transport charge amounting to nearly Rs 400 per wagon load of sand from Allahabad In order to be able to use the local sand stones it would be necessary to grind them to fine powder to make them suitable for glass making It would be desirable to carry out experiments to find out how best to use the local sand stones, and the suitably graded river sands for making glass of different kinds This will help to cheapen the product, and make the factory independent of outside supplies

The factory has been for some time past making glass house pots or crucibles for melting glass by using the fireclay available at Jagannathaprasad Glass house pots were formerly imported from Japan Since the time Japan entered the war and the Japanese imports ceased the factory has been finding it profitable to manufacture these pots, and to sell them to glass works in Madras and Ceylon It has also started making firebricks furnace slabs and rings Thus the nucleus of a refractory or ceramic industry has already been laid at Baring and the proprietor is anxious to expand these activities and set up a separate factory as soon as he can get lease of the fireclay deposits and of the factory site Every encouragement should be given to this new venture to start another line of manufacture in Orissa

2 *Future Prospects*—The consumption of glass can be taken as a measure of prosperity of a country as upon the demand for glass depends the degree of industrialization of the country The chief raw materials used for making glass are silica or sand, alkalies and lime stone The minor ingredients are boric acid magnesia, alumina, and oxides of arsenic antimony, phosphorus, lead, barium, and zinc Manganese and arsenic oxides are used for decolorising while for imparting various colours to glass oxides of copper cobalt, iron nickel chromium lead and tin etc, are added either alone or in suitable mixtures For making bottle glass for every 1 000 parts by weight of sand 330—400 parts of soda ash, 10—15 parts of salt-cake 180—230 parts of lime, and 0—2 parts of arsenious oxide are used Of the major ingredients, silica is the main constituent of glass and if colourless glass is required the quantity of iron oxide present in silica should not exceed 02 per cent Above this a decolouriser must be added If the iron content is over 1 per cent the glass has a dark green colour, and only green bottle glass can be made from such sands River sands can be used if they are sufficiently fine grained and free from iron But generally their iron content is high, and they are good only for bottle glass Irregular deposits of fine grained and pure sands are found in the river beds of Orissa, but they have to be sieved and properly graded before they can be used Such sand deposits are rather of a shifting nature because the sand beds in the river usually change their position with the annual floods

Friable and fine grained sand stones which can be easily crushed are also used for glass making In Orissa some of these Gondwana quartzites and sandstones which are sufficiently fine grained occur near Naraj and the neighbouring tracts, and at several other places Their iron content is somewhat high But they can be used with suitable decolorisers to make colourless glass or can be used as such for making cheap glassware Numerous veins of quartz are scattered throughout the rocks of the Province, and particularly in some of the Orissa States many of which could provide after crushing a quartz sand suitable for the finest quality glass If quartz could be used crushed quartz is likely to be cheaper than the imported sands

Elsewhere the possibilities of manufacturing soda ash in Orissa have been discussed Soda ash constitutes nearly 40 per cent by weight of ordinary glass

So when soda ash is cheaply manufactured locally, it may be imagined what a great impetus it will give to the growth of the glass industry in the Province Further when the country gets opened up and communication facilities develop the lime stone available both in Koraput and Sambalpur and in small quantities in several other places could probably be used for glass making To make colourless glass great importance is attached to using decolorising agents Of these manganese and arsenic have proved to be most satisfactory Manganese deposits have been found in Koraput and the chemical grade ore could be used for the glass industry Good quality chrome ore would be available from the neighbouring State of Keonjhar Among the minor ingredients used for making glass bone ash bauxite dolomite felspar oxides of iron and chromium could be available either in the Province or in its neighbourhood As regards fuel and power either wood fuel in suitably designed furnaces or coal obtained from Talcher or Rampur can be used These coals if treated by the low temperature carbonisation process would probably prove better The design of the furnace is of primary importance for making glass and methods have been devised in the United Provinces recently to obtain higher temperature with economic use of coal for fusion and melting of high quality glasses Cheap electricity when available can be used for crushing the quartzites, and sand-stones and for other grinding operations Labour both skilled and semi skilled is available in plenty But to make better quality glass it would be necessary to have some students trained in glass technology either in the United Provinces in India or in the United Kingdom or the United States of America

3 *Cottage Industry*—Glass can be worked both as a factory industry and as a cottage industry The production of glass on a small scale and making of glass bangles beads and bottles have long been a cottage industry in India centred round Firozabad in the United Provinces Belgaum in Bombay and in the Mysore State The workers mostly purchase glass blocks from factories and make them into bottles and bangles etc in small furnaces in their homes In the United Provinces there are some thousands of such cottage workshops It is gathered, that in Bijnor the cottage workers turn out small bottles that can not only compete with but are sold even cheaper than the factory made bottles It would be worthwhile to study the process of manufacture on the spot to find out if it would be possible to introduce such a process in Orissa

Glass beads and pearls worth several lakhs of rupees are sold every year in India They are mostly imported and previously only the crude beads used to be made at some places in the United Provinces The manufacture of fine beads has been introduced in the United Provinces as an entirely new cottage industry following a process unknown before in India and several hundred people are engaged in the manufacture The glass technology section at Benares evolves new types of decorative glass for the beads and bangle industry and the Government of the United Provinces have started a training centre there for teaching the manufacture of glass pearls and beads to cottage workers They are also assisting the production of such beads by these trained cottage workers The possibility of introducing such industries in Orissa ought to be thoroughly investigated

Bangles are worn by all women except widows in Orissa and in fact throughout India So they have a very wide market Glass bangles are made in Orissa at some places in the district of Sambalpur such as Sohala, Kusumpur, and Vateli They are also made at Anlashpur near Berhampur in the Ganjam district The bangles at these places are made with glass imported from outside or with broken pieces of bangles collected from different places This is an industry that deserves the greatest amount of encouragement in view of the vastness of the market There is a demand for bangles in all homes both rich and poor and it would be desirable to encourage bangle making to meet this demand and cut down imports The manufacture of bangles as a cottage industry has been largely organised in the United Provinces and in Ferozabad alone some seventy three thousand people are almost entirely engaged in bangle making A glassfurnace has also been evolved for the use of these cottage workers The glass industry has come to stay in Orissa and as it expands it

would be desirable to extend its benefits to a wider section of the people of the Province This can be done by introducing on a large scale the various cottage industries based on glass as has been done in the United Provinces Whether this can be done in Orissa or not is a matter that is well worth investigation

B. Refractories

1 Fireclay

General—Refractory wares are those that possess the property of withstanding a high temperature For lining furnaces and for preparing gas retorts, crucibles muffles, etc , materials must be found which can withstand without deformation or decomposition the high temperature at which they are to be used Such materials are included under the general name of refractories The most important material is fireclay For high grade refactories the fireclay is mixed with flint clay or bauxite Silica wares are made from quartz or quartzite Small quantities of chrome ore, manganese, dolomite, graphite, carborundum corundum, and alundum are also used The fireclay is mixed with a certain proportion of "grog i e , calcined and ground clay to reduce shrinkage, and is moulded into bricks, crucibles, etc , by hand Retorts are moulded part by part, one section being allowed to dry partially before the next is formed The shapes are dried, and then burned in kilns before they are used in furnaces

Refractories are divided into three classes—acidic, basic, and neutral The best acidic refractories—the silica bricks are made by using silica and lime Nearly all fireclay is acidic The basic refactories are magnesite, dolomite, and limestone Magnesite is used for electric furnaces, and for research work, magnesite bricks are very valuable owing to their great resistance to high temperature

Occurrence materials—Fireclays occur in the Sambalpur district in the Rampur Coal Field area at Jorabaga, Darlipali, Rampur, Bundia, Katabaga, Kudopali, Amapali, Kararama, Balput, Chuabberna and Talabira The fireclay deposits at Jorabag (21° 47 84° 52) and Darlipali (21° 46 83° 51') have been prospected by the Tata Iron and Steel Company About 1,000 to 1,200 tons of fireclay are reported to have been despatched to Tatanagar via Belpahar on the Bengal Nagpur Railway Other deposits besides those mentioned above are likely to be found when the area is mapped in detail Several of the deposits of kaolin in the Koraput district could be used for making refractory brick and furnace linings but they cannot be worked at present for want of cheap transport facilities The most accessible deposits are those in the Khurda subdivision at Bharatpur, Jagannathprasad, and Barhpita

Silica is extensively used in the refractory industry for the manufacture of silica bricks Silica is obtainable in the form of quartz Quartz of sufficient purity is widely scattered in Ganjam Koraput and Sambalpur districts A number of quartz deposits are found at Binchana (19° 49' 84° 36') Turugudi, Dura, Dwaragam, and Jarada in the Ganjam district There is a big deposit of quartz in the hills surrounding Jarada and it is reported that it extends over 3 to 4 miles The quartz would be suitable for making white pottery as well Dolomite, graphite, and bauxite are all available within the Province

The proprietor of the Sree Durga Glass Works at Baraog has got plans ready to set up a separate factory for making refractories and when such a factory is put up it can use the deposits of quartz, and fireclay at Naraj in addition to those in the Khurda subdivision

The resources of fair quality fireclay are by no means small in Orissa, and any fireclay refractory industry that may be set up can be assured of supplies for long times to come But the development of the industry for making refractory materials will depend upon industrial expansion in other directions in the Province such as the manufacture of cement, iron, steel, paper, glass, etc , because their furnaces will require the constant use of refractory materials So there is enough scope for the refractory industry to develop with the industrialization of the Province

2 Graphite

Graphite is a highly refractory material and is used mainly for making metallurgical crucibles Graphite has no binding property and must be mixed with a plastic fireclay To this mixture quartz grog or asbestos are added in different proportions according to the purpose for which the crucible is to be used The use of graphite crucibles has somewhat diminished as electric furnace steel is gradually replacing crucible steel Still it finds extensive use in melting brass, and other non ferrous metals There is no graphite factory in Orissa proper but there is one in the Patna State The Patna State Graphite Co Ltd, at Titlagarh, and the Indian Crucible Works at Rajmahendry are two of the most important makers of graphite crucibles in India Most of the graphite mined in the Koraput district goes to the crucible works at Rajahmundry some amount of graphite is used as facing in foundry work and for this purpose generally the poorer qualities are used. The finest grade of graphite is used as a lubricant either alone or mixed with suitable oils Some quantity of fine quality graphite is also used for pencil making Graphite deposits which are known to occur in the Eastern Ghats could be worked into crucibles, lead pencils and graphite lubricants Generally the natural deposits contain various impurities So it is necessary to improve the quality of the graphite to make it suitable for making crucibles, and for use as lubricant. The quality usually improves by washing But the flotation method provides the best product with minimum loss

In Koraput the deposits occur near the Bissemcuttack (19° 28′ 83° 27′) Railway Station and at Chuchukona (19° 09′ 83° 15′) The chance of getting large deposits near Bissemcuttack does not appear to be very favourable The quality of the deposits is not very good but being near the railway station, transport facilities are available At Chuchukona the graphite is fairly pure and appears to be of good quality A crucible manufactured with this graphite stood up to a temperature of 25 melts, i e , 1,630° C and some samples of ore were found to be 92 per cent pure Graphite is also obtained at Ambadala (19° 40′ 83° 28′) and at a number of other places in the Koraput district In Sambalpur graphite has been found in a strip of country about 20 miles by 5 miles in the Nowopara subdivision on the border of Patna State The chief localities in the area are Babupalli, Gandamer, Baghamunda, Kominn and Bilianjore all in the Nowapara subdivision Further work in this area will probably bring to light additional deposits These deposits do not appear to be of a high grade and the mineral would need further concentration The chief graphite deposits lie beyond the border of Orissa in the Patna State, and to some extent in the Kalahandi State The deposits are also not of a high grade But they could be profitably marketed if arrangement can be made for further beneficiation by putting up a flotation plant preferably at a central place where all the raisings from the deposits in Orissa, and the Orissa States could be handled together Some kind of working arrangement will have to be made with the States concerned It would be better to work the beneficiation plant in conjunction with plants for the manufacture of crucibles or other graphite products requiring a high grade of graphite By such co operative effort between Orissa and the Orissa States an industry of fairly good size could be built up as there is a growing demand these days for graphite products in India, and the demand is likely to increase as the pace of industrialization quickens

3 Graphite Pencils

The Co operative Home Industries, Ltd of Berhampur have been making some pencils on a cottage industry basis Due to the scarcity of pencils in the market now a-days, these pencils are finding a good sale But unless they are substantially reduced in price, it will be difficult for them to compete in the market in normal times It is hoped however, that as the workers get experienced they will make better and cheaper pencils

A pencil factory has been recently erected in the premises of the Orient Paper Mills at Brajarajnagar in the Sambalpur district The factory began production only 2 3 months ago, and has been manufacturing pencils at the rate of nearly 50 grosses a day The plan is to produce ultimately 100 grosses of pencils a day The management proposes also to take up the manufacture of

penholders, and nibs The chief ingredients used for making pencil are graphite, clay, and soft wood At present the factory is getting graphite from Calcutta, clay from Mysore, and soft wood from Baluchisthan Graphite is available in the Province but it has to be made grit free There is no dearth of fine clay in Orissa, and it may be possible to find in Orissa's vast forests some varieties of soft wood that would be suitable for pencil making With probably this idea in view the words "Orissa Forest Product" have been stamped on some of the pencils made at Brajarajnagar although no such product is being used at present in their manufacture

C. Potteries and tiles

Pottery manufacture is one of the most important village industries in the Province The potter's clays are widely distributed in Orissa, and are used for the manufacture of cooking pots water vessels, and pots of various shapes and sizes for storing foodgrains, and for numerous other uses The articles made by the village potters are universally used in all homes in Orissa both rich and poor At some places the village potters make also roofing, flooring and ceiling tiles drain pipes, and earthenware rings for wells

Some of the village potters work also as brick layers, and toy makers The toys made specially at Cuttack are quite artistic in design, and could find a market outside

Tile making ought to be encouraged on a large scale for roofing purposes so that the straw used for thatching could be released for cattle fodder In the district of Ganjam most of the houses have got tiled roofs but the people there buy large quantities of what they call the Mangalore tile from outside the Province Some of the village potters at Lathi have now learned to make such tiles, and are selling them cheap Such tiles are called Raniganj tiles in North Orissa There is at present a fairly good tile factory at Jeypore, and the one at Rayaghada is likely to resume manufacture soon A tile factory has also been started at Nuabazar near Cuttack But none of these factory made tiles are glazed like the Raniganj tiles Consequently they soak water during the rains The tiles are not also sufficiently thin, and their cost is rather high The industry needs technical help to improve the product, and a very useful purpose would be served if the tiles could be even salt glazed Some students ought to be deputed to learn improved methods of tile making, and glazing in the factories in Bengal Almost every place in Orissa has got deposits of clay suitable for tile making and there is a growing demand for tiles in towns as well as in the villages But there seems to be lack of enterprise to take up tile making on a large scale, and at a large number of places A very useful purpose would be served by teaching the village potters to make such tiles as in that case they would be readily available to people in rural areas, and would probably be cheaper in price This would bring a new employment to the village potters scattered widely all over Orissa

D. Ceramics and Chinaware

1 *General*—Under this heading may be considered all articles of pottery, stoneware, porcelain, and chinaware, etc, the essential ingredient of which is clay The manufacture of white potteries is essentially a craft which allows for the expression of the artistic talents of the craftsmen The chief clays used are the ball clays or claystones for stoneware and china clays for chinaware, and porcelain China clay as the very name indicates is an essential ingredient for the manufacture of china and porcelain The clays are first mixed thoroughly with sand crushed quartz powdered pottery, bonemeal, flint, felspar, and lime, etc, with substances added to produce colour, lustre, and opacity etc Then they are moulded into shape, and are burned in a kiln or oven Glazing is effected by a second firing The glaze contains borax, sodium or potassium carbonate, and some lead compounds Glazes are compounds of silicates consisting of a mixture of silica base and metallic oxides that fuse to a glass when heated

Low grade fireclays are used for making stoneware The fireclay is burned to a temperature of 1400° to 1500° C at which temperature the iron content of the clay, if it is sufficient, acts as flux Otherwise it has to be mixed with an impure clay of low fusing point which will serve as flux, and bind the fireclay

particles into an impervious body As chemical industries grow, there will be greater demand for chemical stoneware such as acid jars, stills, condensers, and pipes The provision of sanitary facilities in increasing measures will also create a demand for sewer pipes which are made of a mixture of fireclay, and surfaceclay These sewer pipes are usually salt glazed

2 *Raw materials*—As far as the minor ingredients such as flint, felspar, lime, and bonemeal are concerned they are all available in the Province Some of the mineral pigments and ochres could be used as colouring matter But the chief ingredient used in the manufacture is china clay The best quality china clays which can be used for the manufacture of chinaware and white porcelain goods are white in colour China clays are also used as fillers in textile and paper industries The best and the largest number of china clay deposits are in the Sambalpur district Chuhukitikra (21° 39 84° 09) which is 8 miles from Rengali, a station on the Sambalpur branch of the Bengal Nagpur Railway is reported to be the most promising area The clay when washed is of excellent grade, perfectly white gritless, and plastic The deposit at places contains as much as 90 per cent of almost grit free, excellent white clay with rare iron stainings The area deserves careful prospecting There is a white clay quarry at Baresingharı (21° 25 83° 56) about 5 miles away from Sambalpur from which nearly 2 000 maunds of clay are being exported every year The deposit seems to be fairly extensive, and others are expected to be present in the locality The proportion of clay is up to 50 per cent, and the material when washed is of excellent quality China clay of the kaolin type occurs at Ghicha mura (21° 45 84° 06), Sagunpalli (21° 35 84° 01) Banjipali (21° 21 83° 46) and Katapali (21° 24 83° 37) A white clay which may be used as china clay occurs in the Gondwana rocks at Baripahar (21° 46 83° 47) and similar white clays occur in the Cuddapah rocks at Khola (21° 39 83° 39) and Lukopah (20° 46 82° 33) The Belpahar station is only 5 miles away from Baripahar and the white clay found there could be employed either for refractory making or for making glazed stoneware and tiles, etc Khola is 18 miles from Jamga a railway station on the other side of the Mahanadi The quality of the clay found here is good, and on account of its whiteness freedom from grit, plasticity, and refractory properties it would be worthwhile to prospect this area to deter mine the extent and thickness of the clay bed The clay deposits at Lukopah in the Nawapara subdivision are within 2 miles from the railway The clays found there are suitable for industrial purposes, and the area promises to yield considerable quantities of clay

In the district of Cuttack china clays are known to occur at Naraz (20° 28 85° 46), and at Brahmanhil (21° 03 84° 56) and Patrapara (21° 05' 84° 46) in the Angul subdivision Generally the Naraz clay is white with stains of iron here and there It is fine to moderately gritty A compact cream coloured, plastic, and grit free clay is found on the Sidheswar hill near Naraz The clay found in Patrapara is hard, fine, and plastic but the Brahmanhil clay is gritty

In Ganjam small deposits of china clay are found at Gundaranga, Dwaragam Polosora and Buguda Several white clay deposits occur in various parts of the district but the deposits so far found are small and the clay requires careful washing to remove grit It is probable that other deposits will be found during further mappings in the district

In Koraput there are several known deposits of china clay, and it appears that the laterite plateau contains scattered deposits of kaolin These occur at Deodra, Beopariguda, Uduguda, Musoriguda, Pukhli Jodiguda Nuagam and Ambodala The cream coloured clay obtained from Deodra (19° 18 82° 45) deposit is close to the motor road, and seems to be extensive The material is sandy and is stained by oxides of iron The quality could be improved by washing and sun bleaching Tests conducted in the laboratory of the Geological Survey of India indicate that the clay cannot be utilized for the manufacture of high class porcelain ware but it is suitable for the manufacture of inferior types of ceramic ware, stoneware, etc , and for use as a filler in textile and paper manufacture The other deposits are not extensive, and so far as is known the clays are not of a superior quality

In Puri district the knowa deposits af clay are all within tho Khurda subdivision and aro mined in tho Barhapota (20° 20 85° 51) Reserved Forest and at Bharatpur (20° 18 85° 47) and Jagannathprasad (20° 20 85° 46) Ths clays are associated occasionally with ochre Tho beds have olready been worked on a small scale at a few places and tho clays are despatched to Berhampur for use as toxtilo fillers In tba Borhapeta Reserved Forest tho bed is prohably continuous over a considerahlo aroa, and it is necessary to determine tho dimensions of tho deposit Tho clay is greyish whito to whito in colour Its plasticity is good It could be used either as refractory clay or mixed with other clays for the manufactnre af atoneware Tho Bharatpur and Jagannathprasad clays also extend over a consideraols area and are soft, fine, plastlc, and white

Thus it will be seen that there are fairly good deposits of china-clay availablo in the Provinco Several of these deposits will bo found to occur over a rather larger area than that visihle at present, and appear to be of sufficiently good quality to warrant dovelopmeat. Soma of tho clays are of a quality suitahle for the manufacturo of whito pottsry, and otber ceramicware

Porcelain hesides its use in making crockory is also a good material for electrical insulation, and is very mucb in demand by tho electrical industry As large schemes of electrification in Orissa are at present under coatemplation there will bo a good deal of demand for porcelain insulators in future

As ths hest doposits of china clay aro in Sambalpur, Jharsnguda with its proximity to coal and industrial centres seems to bo quite a good locality for establishing a factory Besides china clay aome of tho other materials reqnired for making porcelain aro also availahls nearby For instance dolomite-limestone can hs obtained from Sulai Padampur and Putha in tho Sambalpur district or from the Oangpur Stato Felspar could be obtained from Laikera, Laira, and Gambharpalli and whits lithomargo from Akhradand, all in tho Sambalpur district Quartz of special purity could be obtained from the quartz veins around Jharsuguda, Rengali, Gumlai Naikpara and Parmanpur Some of the pigmeats such as ochres, and siennas found in ths iron and manganess ors areas could also find uss as colouring materials in ths pottsry industry So Jharsuguda possesses distinct advantages for the location of the Indnstry

E. Cement

1 *General*—Ths cement industry is a well established industry in India The cement factories are scattered throughout the country hut most af them are situated in ceatral and northern India They produco abont 200,000 tons of cement a month most of whicb is now going to meet war requirements Because of the heavy cost of transport, proximity of the markets is an important consideration but factories are generally located aear supplies of limestone which is the chief raw material for making cemeat

2 *Raw materials*—Besides limestone the other raw materials used are clay, and gypsum In addition coal is required for fuel, and power To make 100 tons of cement, 160 tons of limestone, 4 tons of gypsum, and 38 tons of coal are needed Where electricity is available approximately 100 units of electricity are consumed per ton of cement Because of the heavy weight of the large quantity of limestone required, cement factories are located near deposits of limestone to economise the cost of transport

3 *Manufacture*—Portland cement is made by first grinding limestone and clay mixed in suitable proportions either with ar without water The mixture is then fed into a rotary kiln at the top where it meets tho uncoming hot gases As the kiln rotates the materials fall down slowly towards the clinkering zone where a higb temperature is maintained by the combustion of pulverised coal blown in by a powerful blast of air Here the materials partially fuse and form the clinker which is then ground with the gypsum in ball or tube mills to a fine powder This powdered substance is cement

4 *Markets*—For the last few years most of the cement produced is going to meet the urgent war requirements So a large number of public works projects and construction of private buildings have been held over These as well

as the huge programme of construction of roads buildings and bridges contemplated under the post war plans of development will create a great demand for cement during the post war period When major projects like hydro electric and irrigation schemes involving large quantities of cement are taken up the demand will be still more intensified A rapid industrialization of the country would also lead to large increase in the use of cement To meet these increased and urgent demands new cement factories will have to be put up As Orissa s demand for cement for the hydro electric and irrigation projects will be heavy Government ought to consider early the plan for putting up a cement factory in Orissa to meet the post war needs

5 *Limestone in Orissa*—The cement industry has not developed in Orissa because the local demand was not enough to absorb the greater part of the production of a factory Very little was also known about the deposits of limestone in the Province It is now known that limestone deposits occur near the Sabari river in Malkangiri taluk at Kottametta (18° 20 81° 42) in the Koraput district The limestone is of excellent quality, free from sulphur and phosphorus and contain nearly 96 per cent calcium carbonate This limestone would be suitable not only for cement making but also for the more valuable chemical and glass industries where a high degree of purity is es entially required It could be used for the manufacture of calcium carbide and cyanamide when cheap hydro electric power becomes available Limestone is found also along the Kolab river near Gupteswar (18° 49 82° 10) and Sirivada (18° 50 82° 10) At Sirivada dolomite limestone is found in the bed of the river The coastal side of the Eastern Ghats may contain deposits of limestone but the region has to be mapped in detail for the purpose

Extensive deposits of limestone and dolomite s uitable for lime burning and cement making occur in the Sambalpur district Such deposits have been located at Sulai Padampur Laxmanpur, Dungri and the neighbouring places Abont 5 million tons of dolomite limestone are available at Sulai (21° 58 84° 06) near the Gangpur border and the deposit is easily accessible being only 6 miles from Dhutra a station on the Bengal Nagpur Railway Dolomite is also available at Padampur (21° 45 83° 34) and Laxmanpur Extensive deposits of limestone occur in a strip of plain country 8 miles long and 1 mile broad round Dungri (21° 42 83° 34) and the adjoining villages of Saountmal Badmal Behera Kusumda, and Banjipalli (21° 38 83° 30) The thickness of the bed as can be judged at present varies from 15 to 30 feet In the absence of detailed prospecting it is not possible to estimate the quantity but several hundred million tons of limestone of which an appreciable quantity may be high grade material are there Thorough prospecting and sampling of the deposit will be necessary The material could conveniently be brought to Dungri and from there to Padampur but this would involve crossing the Mahanadi river Analysis of samples shows that the deposit contains 86 4 to 89 per cent pure lime There are deposits of dolomite in the Sambalpur district at Putka (21° 10' 82° 58) and at Nawapara (21° 09 82° 57) in the Bargarh subdivision The material is however, of inferior quality and is good only for the manufacture of lime

6 *Prospect of cement industry in Orissa*—Thus it will be seen that the best deposits of limestone are in the Sambalpur and Koraput districts The Sambalpur deposits are more easily accessible and with the Rampur coal available nearby the possibilities of establishing a cement factory in the Sambalpur district preferably near the Mahanadi are much more favourable This factory when built will cater mostly to the needs of Sambalpur and the adjoining Orissa States It is doubtful if the demand in these localities will be great enough to absorb the major part of the factory s production The ques tion of cheap transport will have to be solved in order to make the cement available to the coastal districts of Orissa It has also to be remembered in this connection that the factory in Sambalpur will have to face severe competi tion from a very big factory that is now being built at Chanbasa by a powerful cement combine in India

As regards the Koraput deposits they are inaccessible at present but with the development of roads they may become available There will be great demand for cement in this undeveloped area not only for the roads buildings and

bridges but also for the two hydro electric projects at present under the consideration of Government There is no cement factory in the area to compete with and if railway transport can be provided an export market could probably be found to the East via the Vizagapatam harbour An additional consideration and a weighty one is that the factory would provide a useful load for the hydro electric station which would be very much in need of load during the initial stages of development The extent of the load can be judged from the fact that the Dalmia Cement Factory consumes nearly 2 300 K W out of 16 000 K W generated by the Mettur Hydro Electric Works and the Madukari Cement Co consumes 3 700 K W out of the total output of 31,000 K W from the Pykara Hydro Electric Works of which it is the highest single consumer So by putting up a cement factory with a production capacity of say 50 000 tons within the pay load area of the hydro electric station a load of nearly 5 000 K W could be found for the hydro electric works But in the absence of transport facilities it would be a problem at present to bring coal to this area As coal and gypsum which will have to be brought from very far off places constitute nearly 42 per cent of the weight of cement their transport will be highly expensive and it would be difficult to carry this heavy load without railways What part of the coal requirements can be met by charcoal fuel and electrical power is a matter for further investigation The prospect of the cement industry in the Koraput district though tempting its materialisation at present seems to be well nigh impossible as no coal is available nearby If the Sambalpur project materialises most of the plant required could be obtained in India but things like power plant electric motors and boilers, etc will have to be imported Labour would be easily available but for the technical personnel it would be necessary to arrange for the training of some young men in some of the existing factories in India

F Enamelware

The composition of enamels is very similar to that of glass In enamelling an opaque glossy coating is given to articles by covering the articles with a suitable composition and then heating them to a temperature sufficient to cause vitrification i e partial fusion of the coating The articles that are generally enamelled in this way are sanitary vessels wash basins, iron vessels for domestic laboratory and hospital use industrial parts and pottery The chief ingredients required are steel sheets of various gauges and chemicals such as borax sulphuric acid soda ash etc The steel sheets will have to be purchased from the big steel manufacturers or re rolling mills There is scope for such a mill in Orissa The development of the chemical industries will help the establishment of an enamelware industry in the Province by making the necessary chemicals readily available But for the present the demand for enamelware in Orissa is negligible As all the raw materials will have to be brought from outside and the local demand for the finished product is not great it is unlikely that the manufacture of enamelware will start in the Province in the near future

XI SOAPS, OIL-PAINTS, COLOURS, AND VARNISHES

A Soap

1 *Existing industry*—The Haru Soap Works at Kharar Road on the Raipur Vizianagram line of the B N Ry is the biggest soap factory in the Province It can produce about 80 maunds of soap a day but due to difficulty in getting raw materials and railway transport facilities the factory has been forced to cut down its production to 40 maunds a day The factory produces at present some toilet soap but it mostly makes bar soap for washing purposes The factory intends to take up the manufacture of good varieties of toilet soap and to recover glycerine which is a valuable by product as soon as the supply position becomes easier and transport facilities become available The factory uses coconut groundnut and castor oils and is dependent for the supply of oil on the Cochin State and the Madras Province The factory is at present buying nearly 2 lakh rupees worth of oil from outside Orissa The land near Kharar Road and in the Nawapara subdivision seems to be well suited for growing groundnut and waste lands would

be most valuable for the purpose A great good could be done to the cultivators of the locality and to the factory by encouraging the cultivation of groundnuts and castor on a large scale in that area Besides the oil required by the Soap Works, a large quantity of oil cake would be available to be used as cattle food or manure for which there is so much need in the Province

2 *Raw materials*—Soap is made by boiling oils and fats with caustic soda, and these are its chief ingredients Almost any fat or oil can be utilised in the manufacture of soap, the choice being determined by the price of the oil, and the quality and type of soap required The most important vegetable oils used in Orissa are groundnut, cocoanut, gingelly, and castor oils Inferior oils like those of Punnang (*Colophyllum inophyllum*) and Karanj (*Pongamia glabra*) can be used for making washing soaps Some sodium silicate, and in the common varieties of soap frequently cheap mineral loading substances like china clay are added to increase weight Colouring matters, perfumes, and disinfectants are added according to requirements

3 *Future prospects*—Soap is an article of everyday use Its use was formerly confined to urban areas but it is gradually spreading to the villages With spread of education and of ideas of cleanliness, and more specially with the rise in the standards of living, the demand for soap is bound to increase in future It is very desirable to make at least washing soap easily and cheaply available to the people It would be necessary, therefore, to encourage the soap industry in the Province In the manufacture of soap, for every maund of oil nearly one sixth its weight of caustic soda is required Thus the manufacture of caustic soda in Orissa will greatly help to foster the growth of the soap industry in the Province It would be possible to get a few Science graduates trained in some of the Universities in India which provide courses in soap technology But the chief bottle neck would be oil, as Orissa is not self sufficient in the matter of her requirements of oil So before any large scale soap factory can develop in the Province, it is essentially necessary to take early steps to increase the production of oil seeds Adequate supply of the non edible cheap oils could be ensured by planting a large number of Karanj and Punnang trees by roadsides, and canal embankments Punnang grows well in the sandy tracts of the delta, and a few plantations have been started in Puri It would be desirable to have a large number of such plantations As Mohua (*Bassia latifolia*) seeds are found in abundance in the forests of Orissa and the Orissa States its oil would be very suitable for soap making The fruit of the Sal tree (*Shorea robusta*) which is the most numerous of all timber trees in the Orissa forests, possesses sufficient oil which can be used for soap making But the seeds instead of being collected are simply left to waste in the forests If all these sources of oil are properly harnessed there will be no dearth of oil for soap making in Orissa

4 *Cottage industry*—The manufacture of ordinary washing soaps can be taken up as a cottage industry The Madhusudan Village Industries Institute, the Bhagat Chemical Works and many such small concerns, and individual makers are making washing soaps, and selling them in the market But some of the soaps manufactured in this way are of an inferior quality To improve the quality of soaps and to encourage soap making on a large scale a course of training in soap making may be given to a large number of students Non edible oils can be had cheaply in some parts of the Province By arranging for the supply of caustic soda at a reasonable rate to the cottage workers in those areas, local production may be encouraged, and Orissa may not have to buy washing soaps from outside markets as is the case at present

B. Vegetable-ghee

Fats and oils constitute an essential element of food The diet in Orissa in generally deficient in oils and fats as their normal consumption is less than 0 3 oz. per head per day in place of the minimum requirement of 1 5 oz for a balanced diet The high price and scarcity of genuine ghee have created a great demand for the vegetable product There is at present a move to instal a plant for manufacturing vegetable ghee in the Province Groundnut and cocoanut oils are the chief raw materials used in making vegetable ghee Cocoanut is grown mostly in the Puri district but it is not used for oil pressing Some of the cocoanuts are

consumed locally, and the rest are exported They could he made available to the vegetable ghee factory when it starts working Groundnut is generally grown in the district of Ganjam, and the total area under cultivation in 1942 43 is said to be 13 000 acres The setting up of a vegetable ghee plant will, by creating a great demand, give an impetus to the cultivation of groundnuts in the Province Groundnut can he grown on waste lands which are not ordinarily suitable for growing paddy and other crops So by growing groundnuts such lands will he put to good use The oil cake obtained as a by product will meet part of the great demand for manures, and will help to produce more crops in Orissa Another source of oil which is likely to he suitable for making vegetable ghee is the 'Tolo' oil obtained from mohua seeds As mohua trees grow abundantly in the Orissa forests large quantities of oil are likely to be available, and they ought to be tried for making vegetable ghee When oil is turned into vegetable ghee, the oil waste that is obtained is usually turned into soap So the factory will help to produce more soap in the Province

C. Oil-paints and varnishes

1 *General*—Animal and vegetable oils and fats are used for making paints, varnishes and polishes Paints and varnishes are of great use these days both in the home and in the industries Apart from their use for decorative purposes they are necessary for the preservation of all wooden, iron, and metal works which are liable to rusting, and corrosion

2 *Varnishes and polishes*—Varnishes are made by boiling linseed or other drying oils with resins and varnish gums Orissa does not produce much of linseed oil and she does not produce any varnish making gums But she produces a huge quantity of resin which is the secretion of the Sal tree (*Shorea robusta*) Most of this resin is exported The process of using Sal resin for making varnish is unknown in Orissa The making of varnish is a highly developed chemical process As the chief ingredients are by no means abundant in Orissa there is no possibility of the industry developing in Orissa in the near future As some quantity of shellac is available in the Province and the manufacture of denatured spirit is developing the only thing possible at present would be to make furniture polish for which there is a local demand

3 *Paints*—Paints are made by thoroughly mixing powdered pigments with oils which serve as the binder for the pigments To this mixture is added a drier which usually consists of the salts of lead and manganese to accelerate the rate of drying, and a volatile thinner such as oil of turpentine to give the paint the proper flowing consistency Among the other ingredients required for the paint industry shellac beeswax, and some quantity of denatured spirit are available in the Province Among the pigments bauxite, china clay, ochres, iron oxide, and manganese dioxide are also available But linseed oil which is the chief material used in making paints is available only in small quantities in the Province Orissa does not grow much of linseed The total area under linseed in 1942 43 was only 5 600 acres and the production about 20 000 maunds For want of enough linseed oil it is doubtful if any large scale paint industry will develop in Orissa But at the same time it must he pointed out that she possesses some good deposits of ochre which have good covering power and colour to be used for the paint industry This may give rise to a small scale paint industry

4 *Ochres in Orissa*—A brief description of the uses of the ochres, and the places where they are available in Orissa is given below with a view to stimulate interest in the paint and other industries in which the ochres can he used The ochres are permanent colours and are cheap, and inert, i e , they have no effect on other bodies They are widely used for painting steel structures, and exposed iron steel and wood work So they are required in huge quantities for the paint industry Besides their use in paint making they are used in the manufacture of oil cloth linoleum paper and ceramics There is a fairly good demand from these industries for ochres In the Cuttack district red ochre is found at Naraj (20° 28 85° 46) and Talgar, yellow ochre at Sidheswar and Ghasiput (20° 25 85° 37) Red clay is found at Palasa Bani (21° 00 84° 52) in Angul sub division The deposit is large and the material though slightly gritty has good covering power In colour it compares favourably with that of standard good

quality Indian red ochre available in the market Red ochres have been found also in Ganjam But the best deposits of red ochre are in Khondmals at Tansu (20° 29 84 01'), and at Sirkajori (20° 30 84° 02) the latter being the more extensive deposit The colour and covering power are not as good as that of standard ochres Better ochres may be found in this area but the transport charge would be very high Slightly gritty red ochre with a good tint and high covering power compared with the best Indian red ochres available in the market has been found at Sunai (18° 19 82 45) and Geraputtu (18° 30 82° 44) both in the Potangi taluk in the Koraput district Close to the Orissa border to the west of Arallu village (18 20 82° 31) there is a fairly large deposit of excellent red ochre similar to the Potangi deposits Red ochre is also available at Kandagam (18° 50 82° 38) and mottled cream and yellow clays at Boriguda (18° 45 82° 26') both in the Koraput district Deposits of ochre of somewhat inferior quality are found in several places in the Khurda subdivision The material may possibly be refined, and marketed The laterised rocks in Nalibasa hill in Luisa zamindary in the Sambalpur district contain large deposits of red and yellow ochres Red ochre varying in colour from red to various colours of chocolate, soft and even grained in texture is found in the Rampur coalfield area The quality improves on grinding, and washing and it can be marketed

From the foregoing it will be seen that the ochres found in Koraput, and some of those found in Angul are quite good for the mineral pigment industry It is likely that other deposits of good ochres will be found in the laterites Suitable siennas and umbers may be found among the manganese deposits of Koraput It may be possible to obtain by a selection of the mineral earths from various parts of the Province quite a wide variety of tints to be used as colouring media for paints pottery, and other industries

D. Oil-pressing

1 Oil is the basis of the soap oil paint, and the vegetable ghee industry It is used in large quantities also as a cooking medium There are altogether about half a dozen oil mills in Orissa which work either independently or in con junction with rice mills They mostly cater to the needs of the urban areas The needs of the rural population are served by a class of people known as 'Teli' whose family occupation is to press and deal in 'Tel , i e oil They are found all over the Province as they are the people who supply the oil used in cooking food The village Telies use bullock driven wooden oil presses They are now meeting with a serious competition from oil mills and the age old profession is gradually dying out Some effort has been made to revive this village industry by introducing the improved Wardha pattern Ghanies In the interest of rural economy this industry ought to be encouraged It will not only provide employ ment to villagers to serve the needs of the village but also by making the useful oil cakes available to the cultivators ready at hand will help to improve agricul tural production

2 Orissa does not grow enough of oil seeds to meet her requirements of oil, and has to import large quantities of oil from outside But the pity of the situation is that instead of pressing the oil seeds grown in Orissa to meet her internal demand, she exports them to other provinces and buys in return oil from outside The Province suffers a double loss as her people are deprived of an useful occupation, and she loses also the valuable oil cakes which are so much needed to improve her agriculture The approximate areas under the various oil seeds in Orissa and the yield in 1942 43 were as follows —

	Area in acres	Yield in maunds
1 Groundnut	13 000	232 000
2 Castor	19 200	55 300
3 Mustard	26 400	370 700
4 Sesamum	110 858	371 000
5 Linseed	5 600	20 000

From these seeds Orissa can get something like 350 000 maunds of oil But taking 1 5 oz of oil as the minimum requirement per head per day to provide

a balanced diet, Orissa needs for her population of 8 73 millions an annual supply of oil of about 3,700,000 maunds Thus the local production is only one tenth of this quantity This shows what a wide gap exists between the actual production, and the potential demand The present demand is not of course as great as 3 7 million maunds because very few people get a balanced meal, and some of the present demand is also met by seeds such as gingelly and mohua found abundantly in the forest areas But there is also a debit side to the picture as the soap makers consume some of the edible oils though it would be cheaper for them to use the non edible ones The scope for production of non edible oils in Orissa has been already discussed under Soap But so far as the edible oils are concerned there seems to be a very great and urgent need for intensifying the cultivation of edible oil seeds in Orissa

XII. ELECTRO-CHEMICAL INDUSTRIES

A. Aluminium

1 *General*—Next to iron and steel aluminium is the most important industrial metal of the present times It is being increasingly used in aircraft, automobiles, radio, electrical, and other industries It is also being used for structural purposes, and for household furniture In India, however, the largest use of aluminium is for making domestic vessels and cooking utensils Due to its lightness and cheapness aluminium is displacing the heavy brass and bell metal used in making utensils Although India used to consume Rs 50 lakhs worth of aluminium a year until recently no aluminium was being manufactured in India The manufacturing companies used to press hollow ware from imported metal or the metal recovered from scrap, and discarded utensils It was only in 1913 that aluminium was extracted for the first time in India using the ore obtained from Chotanagpur in the Indian Aluminium Company's Works at Jaykaynagar by utilising the cheap hydro electric power available there

2 *Raw materials*—Metallic aluminium is made from bauxite by first digesting the bauxite with caustic soda to get the pure aluminium oxide known as alumina This alumina is then treated in electrolytic furnaces using carbon electrodes The chief raw materials used in the manufacture are bauxite, caustic soda cryolite and carbon rods About 4 5 tons of bauxite or 2 tons of alumina, ½ ton of carbon electrodes, 0 1 ton of cryolite and 25,000 kilowatt hours of electricity are required to make one ton of metal The carbon electrodes and cryolite are to be imported There are good possibilities of manufacturing caustic soda in Orissa

Bauxite is reported to occur in the laterite hill tops of the Eastern Ghats in north Koraput district but no details have been recorded and the only locality given is the Girhguma hills (19° 07 82° 55) Its occurrence is also reported near the base of a laterite plateau north of Mandura (19° 56 83° 13) and on the Nawapara Khariar highlands near the boundary of Orissa and the Central Provinces Although information on the extent of the bauxite deposits in Orissa and the Eastern Ghats is meagre yet from its usual association with the normal laterites which are rather widespread in the hills and plateaus of Orissa it is expected that further occurrences of workable deposits will be brought to light on the high lands of Koraput, Nawapara and perhaps Ganjam by mapping the country in detail It is understood that in the neighbouring State of Kalahandi large deposits of good quality bauxite have been found in the Korlapat hill The analysis of this bauxite is so good that if large quantities exist the tract must prove important for the aluminium industry It is to be expected that there will be good deal of co operation between Orissa and the Orissa States, and the natural resources of both will be jointly available for industrial developments which will benefit both So it may be reasonably expected that the Kalahandi deposits may be available for extraction of aluminium in Orissa which will have the advantage of cheap electric power which plays a vital part in this industry weighing heavily in her favour

For the extraction of aluminium best results are obtained by using bauxite whose alumina content is more than 52 per cent Analysis of some typical bauxites from the known occurrences in the adjoining tracts of Orissa shows that the ores

from Girhguma hills contain about 60 per cent, and those from the Korlapat hills in Kalahandi as much as 68 per cent of alumina If these ores are found to exist in large quantities then it would be reasonable to expect that they will give rise to the aluminium industry But it will have to wait till the hydro electric power schemes are brought into operation, and cheap electricity becomes available

3 *Prospects in Orissa*—Electricity plays a vital part in the extraction of aluminium as nearly 10 K W H of electricity are consumed for extracting every pound of metal In fact it is not so much the availability of the raw material bauxite but that of cheap electricity which decides the location of the industry For example, Canada which is one of the chief aluminium producing countries of the world does not possess much of bauxite, and has to import it from other countries but it has plenty of cheap hydro electric power and on this account it has become one of the leading aluminium producing countries of the world Even in India the bauxite mined in Chotanagpur has to go a long way to Alwaye in Travancore in search of cheap electrical power to be converted into aluminium there With the deposits of good quality bauxite available nearby, and with the possibility of cheap hydro electric power becoming available in the near future Orissa seems to be advantageously situated for the manufacture of aluminium Every effort should, therefore, be made to explore fully the possibility of starting such an industry in Orissa to provide a good load for her electrical grid scheme

B. Calcium carbide

Calcium carbide is the chief source of the gas acetylene which is used as fuel in the oxy acetylene flame, and for lighting purposes The oxy acetylene burners produce intensely hot jets of flame which are of great use for cutting and welding steel, cast iron aluminium, and other metals Its production has become a considerable industry in the industrially advanced countries of the world Calcium carbide is manufactured on a large scale in countries where water power is available at a low cost The centres of production are, therefore, located in Norway, Sweden and Canada The importance of calcium carbide can be judged from the fact that Great Britain imports more than 40,000 tons of calcium carbide per year, and the consumption in U S A and France are still higher India imports all the calcium carbide she needs from foreign countries

Calcium carbide is manufactured by heating together in closed electric furnaces a mixture of lime and coal in the proportion of 3 2 to 1 high temperature of about 2,000°C Good quality limestone suitable for chemical purposes is available in the Koraput district which is also rich in water power resources When the power schemes materialise it may be possible to manufacture calcium carbide for which there would be not only a good internal demand but also an external demand for export purposes to the East By treating calcium carbide further in an electric furnace in an atmosphere of nitrogen we get calcium cyanamide which is an important nitrogenous fertilizer extremely valuable for Orissa soils which are generally poor in calcium In the interest of agricultural development of the Province it would be desirable to encourage the production of this useful fertilizer which will also provide the much needed load for the electric power schemes

C Ferro-alloys

(Please *see* under Iron and Steel)

D. Abrasives

1 *General*—Abrasives are required for all grinding, polishing drilling and boring operations in industries, and their use has greatly increased in recent years They will be needed more and more as industries develop The degree of hardness of a material determines its efficiency as an abrasive The form in which abrasives are used varies for different purposes The material is crushed, and sieved to different degrees of fineness to suit different purposes It is used as loose powder for grinding or is glued on to cloth or paper or is bonded with cement to make grinding wheels, and hones

Of the abrasives occurring in nature the chief ones are emery, corundum, sand and garnet The harder abrasives emery and corundum are not available in Orissa Of the softer abrasives garnets suitable to be used as abrasives have been found in many places in Orissa Garnets are known to be abundant in the rocks of the Eastern Ghats and are generally found in stream beds Garnets are found at Banapur (19° 53' 85° 27') in the Koraput district and near Madpal (27° 07' 82° 45') in Nawapara subdivision Loose garnets are found abundantly in the Nalas They have hardly been put to any use so far Sand which is used as the abrading powder for making sand paper or cloth is available in Orissa in abundance But it has to be properly selected sieved and graded before it can be used For this purpose crushed quartz sand stone and granite which are so plentiful in Orissa can also be used Only paper, cloth, and glue are the other materials that would be needed to manufacture sand paper or cloth By using powdered glass in place of sand glass paper can be produced by the same method For these products there is always a demand from many quarters The industry may be developed also as a cottage industry

2 *Artificial Abrasives* Artificial abrasives have largely taken the place of natural abrasives like emery and corundum because they are tougher, and have a sharper cutting edge and longer life than the natural ones Consequently the manufacture of artificial abrasives has become an industry of great importance But this industry has scarcely developed in India

The manufacture of artificial abrasives depends largely on the availability of cheap electric power which is usually associated with hydro electric schemes The chief artificial abrasives are (*a*) carborundum or silicon carbide, and (*b*) alundum or fused alumina It would not be difficult to make these two important products in Orissa as silica is available in the form of quartz sands which occur in plenty in the Province, and alumina as bauxite is also available Carborundum which is the most important of all commercially produced artificial abrasives is produced these days in large quantities It is made by heating a mixture of 35 per cent coke 52 per cent sand 10 per cent saw dust, and 2 per cent salt in an electric furnace using carbon electrodes A huge current of 20 000 amperes at 75 volts is needed for the operation Carborundum is used in the form of powder either loose or glued on to cloth or is made with binding materials into grinding wheels, and hones Alundum is produced by fusing bauxite also in the electric furnace, and the abrasive industry uses large quantities of bauxite It is gathered that some bauxite is available near the Duduma falls, and it would be best to utilise it in making abrasives Provided cheap electric power would be available there is no reason why such an industry should not be able to compete with imported products The demand for abrasives will grow with the development of industries In view of the rapid industrialisation of India the possibilities of an artificial abrasive industry is well worth investigation

XIII COTTON TEXTILES

A Cotton mill

1 There is no cotton mill in Orissa but cotton weaving is the most important cottage industry of the Province Orissa is not a cotton growing area and the total acreage under cotton in 1942-43 is reported to be only 8 600 acres So Orissa has not got the raw material to start a cotton mill But clothing is a primary necessity of man next only to food in importance Of the four essential requirements of an industry namely raw materials labour, markets, and fuel or power want of raw material should not be the deciding factor against having a textile mill in Orissa Abundance of cheap labour proximity of vast markets including those of the Orissa States, easy access to fuel from the Talcher and Rampur coalfields and possibility of having cheap electricity in the near future are some of the most important considerations in favour of having a cotton mill in Orissa Some of the Oriya skilled labour now employed in many of the textile mills in Bengal would be available for employment in case a cotton mill is set up in Orissa In fact the position of Orissa as regards cotton cultivation is not much different from that of the neighbouring province of Bengal Bengal with so many cotton mills does not produce enough cotton to meet the needs of even a fraction of her mills Even the cotton mills of Bombay and Ahmedabad use cotton from the Central Provinces and often

get long staple cotton from abroad With the Central Provinces bordering on Orissa, it would be possible to get easily cotton from the Central Provinces, and supplement it by the small quantity of cotton now cultivated and more to be cultivated in future in the Province There are large areas of black cotton soil in Sambalpur, Angul, and Bhadrak which are well suited for growing cotton, and if a mill is established the acreage under cotton will no doubt rapidly increase

2 No statistics is available regarding the consumption of cotton textiles in Orissa But the extent of the present and the possible future demands can be judged from some of the facts given below The consumption of piece goods in a year per head of population in some of the countries of the world are as follows —

	Yards
United States of America	64
Canada	37
Germany	34
Malaya	30 6
Japan	21 4
Egypt	19 1
India	16 1

It is estimated that the requirements per head are on an average about 30 yards a year India's consumption of cotton goods is the lowest because most of her people due to poverty go about half naked With the improvement in the economic condition, and standard of living of the people the demand for clothing is bound to grow But even at the present rate of consumption of 16 1 yards per head, Orissa's requirements of cotton cloth for a population of 8 73 millions would be more than 140 million yards a year Out of this only about 15 million yards are produced by the handloom industry in the Province which consumes 14 7 million lbs of yarn turned out by the spinning mills It is said that an average size cotton mill with 20 000 spindles can produce 2 million lbs of yarn per year This shows how vast is the need for putting up spinning and weaving mills in Orissa to supply one of the most essential necessities of life to her people

8. Handloom weaving

Handloom weaving is the most important cottage industry in Orissa, and it is spread all over the Province The number of looms in Orissa is reported to be 50 300, and the number of weavers approximately 169 000 The weavers it is estimated, use 14 72 million lbs of yarn a year, and weave 14 73 million yards of cloth Some of the cotton weavers exhibit considerable taste in colour, and variety of pattern and the textile goods made by such workers are highly appreciated Some of the weaving centres are famous for the special artistic designs that they produce on the woven fabrics e g Dhalapathar and Bargarh are famous for the 'Purda' or door screens that they produce, and Ragadi in Banki is famous for what is called the temple border sari Some of the screens, and table cloths produced are so very artistic in design that there is a demand for them from outside markets including even foreign countries like Sweden The production of such articles deserves every encouragement

The weaving industry though widespread is in urgent need of organisation mainly on the co operative lines The weavers have good deal of difficulty in getting the yarn dyes and colours they need at present, and in marketing their products They have to spend a lot of their time in going to markets to buy the yarn and to sell their piece goods If they could be organised into societies the societies would supply them with yarn and arrange for marketing their products This will save them not only from the clutches of the middlemen but also help them to produce more The Orissa Handloom Marketing Organisation is doing good work in this direction but its activities are rather limited to a few localities at present The weaving demonstration parties can do useful work by instructing weavers in the use of improved appliances and approved modern weaving patterns It is said that by organising some weavers co operatively Orissa stood third in India in the matter of supplying textiles for war purposes This shows what can be done by organising the weaving industry on a co operative basis To increase production fly looms may be introduced in place of the old pattern shuttle looms now in use at some places When cheap electricity becomes available

it may be possible to introduce electrically driven looms of the type used in Japan which will greatly increase production and enable the weavers to withstand better the competition from the big cloth mills

C Dyeing

For the weaving industry in general, and for making fancy piece goods in particular dyed yarn is a great necessity To provide employment to the weavers and to teach the useful art of dyeing to them it is desirable to have the yarn dyed locally in small factories It requires some technical knowledge to dye the yarns properly It is, therefore necessary to have demonstrators trained in the art of dyeing At some of the important weaving centres arrangement ought to be made to enable the weavers to get their yarn dyed according to their needs The Government Textile Marketing Organisation has got its own arrangements for dyeing yarn and textile goods It may be possible for this organisation to train up a number of men to open dyeing centres in important weavers villages

XIV. OTHER TEXTILES

A Wool

There is no wool industry in Orissa worth the name The number of sheep in the Province is not small but the rearing of sheep to get wool is hardly practised anywhere The total number of sheep in Orissa is reported to be 270 000, and they could yield some quantity of wool Thus wool is inferior in quality, and is not fit for weaving woollen cloth But it could be used for some other purposes* The Poor Industries Cottage found that the local wool could be used for making rough blankets ashans , and coars gabuhs or carpets To improve the quality of the wool efforts are being made to rear Bikaneer sheep at some localities in the Province but the number of such sheep is negligible at present To encourage wool clipping in Orissa demonstrations were given in sheep-rearing with good results Some people have been trained to weave woollen blankets with the wool supplied from outside to meet the requirements of the War Board but they cannot pursue the trade as the supply of wool from other provinces has been stopped As the Province has not got enough wool at present, and the climate for most part of the year is warm, the prospect of developing the woollen industry in Orissa is rather remote

B Silk

Formerly there was a thriving silk industry in Orissa The tusser cloth of Sambalpur and the silk sarees of Berhampur were very much prized at one time The import of silk from China and Japan and of cheap artificial silk from other countries dealt a severe blow to the indigenous silk industry So the production of indegenous silk rapidly declined The weavers of Barpalli in Sambalpur are expert weavers of tusser silk and they produce fine tusser articles such as dhoties wrappers shirtings etc At one time tusser silk weaving was the principal industry of the Sambalpur district and the culture of tusser silk worm was carried on in almost every village jungle and the weavers used to get their requirements of tusser from the local forest But silk rearing on the 'Asan (*Terminalia Tomentosa*) trees was not favoured by the Forest Department So silk rearing in the Government forest has almost disappeared Some tusser is available from the forests of the Orissa States but it is insufficient to meet the demand The tusser weavers now carry on the trade with cocoons purchased from Chaibasa and other places but the supply is insufficient

The silk weavers of Berhampur in Ganjam mostly weave mulberry silk imported from outside But the sarees woven by them lack in colour schemes and are of a uniform design So they have not been able to hold their own with the gay coloured fine Benarasi sarees To revive the industry it would be necessary to introduce new colour schemes and modern designs The culture of eri silk seems to have good scope for development in the Province The worms feed on castor leaves and could be reared by any villager by having a few perennial castor plants in the back yards of his house But the chief difficulty is that because of the great heat in Orissa all the worms die out in summer If arrangement can be made to supply the seeds after the rains the rearing of eri silk would provide an useful source of income to the village people If properly encouraged eri silk rearing is likely to become popular in rural areas

Cocoanut grows well in the coastal belt of Orissa, and the chief cocoanut growing areas are in North Balasore, and in the district of Puri Wagon loads of cocoanut are sent from the Sakhigopal railway station on the Puri branch line On an average about 31 thousand maunds of cocoanut are sent out from that station alone It is gathered that export of cocoanuts from the port of Gopalpur a decade ago was as high as 1,540,000 cocoanuts The quantity of coir available from all the cocoanuts grown in Orissa would be considerable Rope and twine making afford livelihood to nearly 4,300 persons in the Puri district, and there is a small export trade in rope made from cocoanut fibre The extraction of the fibre, and making of coir yarns and ropes is done by some low caste people in Orissa on a small scale to meet the ordinary needs of the villagers for drawing water from wells, and for general agricultural purposes The cocoanut husks are mostly burnt in the villages as fuel for cooking purposes Orissa allows her valuable fibres to be wasted in this way, and has to import coir ropes from Malabar A very useful purpose would be served by encouraging coir rope making as a cottage industry There seems to be scope for putting up a coir factory near Sakhigopal which will put to good use the cocoanut husks available in plenty in that area

E. Rope-making

The village homes and cultivators use a considerable quantity of rope for drawing water, and for agricultural purposes But they mostly make their own ropes or get it locally made by some of the low caste men in the villages who make coir ropes The chief materials used for rope making in Orissa are jute, Indian and sisal hemps, coir, and some grasses The quantity of sisal hemp available is small but jute, and coir are available in plenty But for want of suitable organisation, and effort to encourage rope making on a large scale as a cottage industry, Orissa has to import a considerable quantity of ropes and strings As industries develop in the Province the demand for ropes will also grow It will, therefore, be profitable to encourage rope making as a spare, time occupation for the cultivators who have not got enough to do to keep them occupied throughout the year.

F. Hemp

There are two kinds of hemp grown in the Province They are the Indian hemp grown mostly in Ganjam and Sambalpur districts, and the sisal hemp which grows wild over most parts of the Province but is systematically cultivated at two places in the Sambalpur district The total area under Indian hemp in 1942-43 is reported to be nearly 10,500 acres, and the yield approximately 40,100 maunds Most of the Indian hemp is of the Ganjam type, and in normal time most of this material was exported to foreign countries for rope making Some of this hemp is made into rough ropes by the cultivators for their own use

The sisal hemp is a valuable fibre for making specially strong and durable ropes The two important places where sisal hemp is produced are 'Nildungurı', and 'Sithalanapalı' both in the Sambalpur district Sisal cultivation was first introduced at Nildungurı as a new enterprise by Mr Cassey, an European engineer He also set up a small factory for making ropes using these hemps The area at present planted with sisal at Nddungurı is 800 acres out of a total of 1,600 acres owned by the factory In pre war days the factory could produce 75 tons of finished ropes, and used to employ 300 men The production in 1942 43 went down to 50 tons due to the breakdown of the steam engine used for drawing out the fibres The factory wants to buy a 50 H P Diesel engine so that it can push up its production to 120 tons a year The factory does not sell hemp but makes it into ropes of various thicknesses The sisal plantations at Sithalanapah extend over an area of 500 acres, and steam engines are used to extract the fibre The plantation sells the hemp as such and does not turn it into rope It has plans for organising a village industry for dyeing the hemp fibres to make door mats, and carpets It will be a good thing to start this new line of production There is good scope in Orissa for encouraging the indigenous production of the sisal hemp which makes strong ropes for which there is a good demand from the transport, oil, and shipping companies as well from various other industries

G. Hosiery and knit-wear

The hosiery industry is gradually occupying an important place in India and there is need in Orissa for some knitting machines either power or hand driven The latter will be suitable for cottage industry purposes The industry can turn out socks hoses banians, vests pull overs drawers and mufflers which are in great demand by all classes of people The chief centre of production for these articles at present are Calcutta and Cawnpore Some of the factories there are large scale producers with a capital amounting to 2 lakhs of rupees but the majority of them are small scale or cottage industries The industry is well suited to be worked on a cottage scale Some of the machinery is now made in India and can be easily obtained The availability of cheap yarn is an essential factor for the success of the industry on a cottage scale Some cotton mills in India are now producing special hosiery yarn, and it would be possible to arrange for its supply Hosiery goods are greatly in demand at present and the industry can be assured of a good market

H. Web equipment

There is no organised industry in Orissa for making fish nets They are generally made by the village fishermen who mostly work as boatmen They weave nets as a spare time occupation and like knitting they can weave nets even while walking and talking Different kinds of net are necessary to catch different kinds of fish As the fishing industry develops there will be a greater demand for nets But for the present the demand for nets is met by the fishermen making their own nets

XV. NON-FERROUS METALLURGICAL INDUSTRIES

A. Brass and bell-metal

The word non ferrous metals should include all metals other than iron The term in actual practice means only the common metals other than iron the chief of which are copper, lead zinc, tin etc Brass which is the most important and widely used of all non ferrous metals is an alloy of copper with tin and zinc Besides the yellow metal brass a white alloy of lead, copper, zinc, and tin is used widely in Orissa for making domestic utensils, and small water pots while brass is used for making the bigger water containers, and cooking vessels There is no scope for production of any of the important non ferrous metals in Orissa The metal workers either buy the metal from outside or melt old discarded utensils, and scrap to recover the metal There is no factory or large scale non ferrous metal industry in Orissa The industry though widespread is prevalent as a cottage industry, and is confined to certain castes known as 'Thatary' or 'kansari' who carry on this ancestral profession of making bell metal and brass utensils, and vessels in their own homes

There are big colonies of these bell metal workers at different places in the Province, and some of the places are famous for the bell metal produced there For instance Balkati in Puri district, Ghantimunda in Cuttack, and Remuna in Balasore district are famous for the particular types of utensils made there The proportion of the different metals in the alloy used for making the articles at different places differs, so the articles differ in quality It is not so much the colour of the metals but the design, and workmanship for which the articles made at some places are famous Some of these utensils used to find a good market outside Due to scarcity of the non ferrous metals in the market, and the consequent rise in prices the demand for brass and bell metal ware has considerably gone down There is also a severe competition in normal times from aluminium and enamel ware which are lighter and much cheaper in price The industry as a whole is therefore, in urgent need of some improvements In order that the articles may be cheap, it is first of all necessary to make them light in weight. The articles are usually shaped by beating with a hammer by hand Much labour could be saved by introducing moulding and stamping machinery to shape the metal The articles could be given better polish, and made thinner by turning them on lathes, and polishing machines Without improvement in the method of manufacture it would become increasingly difficult for the industry to hold its own against the cheap aluminium and nickel silver ware New lines of manufacture can be introduced by teaching the workers to make brass badges and buttons, hasps and hinges, door handles, padlocks and bolts etc, for which there is a growing demand in the market these days

Orissa exports about 100 000 maunds of hides and 13 000 maunds of skins a year and imports a major part of her requirements of footwear and the whole of other leather goods such as harness saddlery straps beltings bags boxes and cases

3 *Raw materials*—Leather is chiefly made from the hides and skins of cattle sheep and goats Lizard skins make skins and skins of some wild animals are tanned to make some fancy articles but their number is small The hides and skins are first of all soaked in a very dilute solution of sodium hydroxide or sulphide and are then treated with lime to loosen the hair and flesh which are then removed by means of knives, and scrapers This is rather a skilled job and there is dearth of labour for the work as many men are not forthcoming to do this somewhat unclean job Sulphuric acid is then used for pickling the hides before actual tanning The prepared skins are then tanned by long immersion in aqueous extracts of tanning materials Modern tanning is of two kinds vegetable tanning and chrome tanning Vegetable process is best suited for tanning thick leathers which are suitable for making soles harnesses boxes and belting etc This leather is generally suitable for heavy manufacture while chrome tanning gives a soft leather for making boot uppers and bags etc Vegetable tanning takes much longer time than chrome tanning but chrome tanning requires greater technical skill and closer scientific control Potassium bichromate is the chemical that is usually used for chrome tanning and at present it has to be imported As good quality chrome ore is available in the State of Keonjhar nearby it would be possible to manufacture bichromates when the chemical industry develops in Orissa For the vegetable process tanning materials such as the bark of Babul (*Acacia arabica*) Sunari (*Cassia fistula*) Korodi (*Cleistanthus collinus*) Dhadhi and Tulwar (*Cassia auriculata*) trees and fruits such as myrobalans (*Terminalia chebula*) and Bahada (*Terminalia belerica*) are used in large quantities Myrobalan contains as much as 33 36 per cent tannin and is used much more than the other materials All these tanning materials are available in plenty in the forests of Orissa and of the neighbouring States It is said that in 1937 38 as much as 1 080 000 maunds of myrobalans were exported from Orissa There is no doubt that large quantities of myrobalans are exported It is gathered that Jeypore Samasthanam gets a revenue of as much as Rs 20 000 a year by leasing out myro balans from the State forests It will be seen therefore that there is no dearth of raw materials for the tanning industry in Orissa But initiative and enterprise are lacking to turn these raw materials into finished products

4 *Future prospects*—Because of the poverty of her people the use of footwear in Orissa at present is much less than what it is in other provinces of India There is much room for the expansion of the industry not only in Orissa but also in India as a whole because the need for footwear is next in importance to that of clothings The war has created a great demand for leather goods and it is feared that with the termination of hostilities the demand for leather goods will go down But there need be no apprehension on that account as a wider export market will be available for this industry as soon as sufficient shipping space becomes available With the increase of purchasing power of the people as a result of the various measures of post war development the internal demand will also rise There will also be increased demand for trunks boxes and suitcases and various fancy leather goods Orissa has plenty of hides and skins and is rich in tanning materials She ought to put these valuable resources to profitable use by organising a number of tanneries and work shops for producing finished leather goods

To organise the industry it will be necessary to improve the process of flaying and preserving the hides and skins This is at present left to some low caste people who are entirely ignorant of the importance of the processes for enhancing the value and grade of hides It is necessary to teach these people proper methods of flaying salting and curing the hides before despatch to the tanneries The necessity of teaching these methods to village people is great in Orissa because of the fact that only a few of the cow hides are obtained from slaughtered animals while more than 90 per cent of the cattle and buffalo hide are derived from animals that die a natural death The hides of these dead animals are preserved only by drying The village Chamars who flay these cattle are too poor to afford the price of the salt needed for curing the hides There is need also for training

fruits, and vegetables Pending the starting of a modern canning factory, a beginning could probably be made by starting a bottling factory to make sweetened mango chutnies and preserves, tomato sauce, lemon and orange squash Not only there is a local demand for such products but markets could easily be found in other provinces

B. Fishery

1 *General*—Fisheries constitute one of the basic food industries, and of the potential industries of Orissa fishery is an important one The development of this important source of food would help to make good the deficiency of important nutritional elements such as proteins, fats, minerals, and vitamins in the Oriya food In addition fisheries supply many articles of importance for arts, and industries Fish fertilizers are recognised as very good plant food Some fish oils are rich sources of, vitamin, and are very valuable for medicinal purposes The use of fish oil for hyrdogenation, soap making, and other purposes is increasing Shark skins can be made into fine leather for making hand bags, and fancy leather goods, and there is a market for shark fins too From fish scales is derived an essence which is used in the manufacture of imitation pearls Fish which is unfit for human consumption can be converted into fish glue It will be seen, therefore, that almost every product of the fishery industry has got some use or other

2 *Marine fishery*—The proper development of fisheries will provide direct employment to hundreds of people, and will yield a surplus of fish for export to other provinces The fishery wealth of Orissa is enormous, and she possesses all the three types of fisheries viz , marine, estuarine, and inland The potential fishing areas in the Bay of Bengal have hardly been tapped Orissa has a coast line of about 250 miles of which 90 miles are covered by river mouths Fishing is as done at selected localities only within 3 miles of the beach but deep sea fishing is unknown This foreshore fishing which is limited in extent is carried on by Telugu fishermen called 'Noliyas' They use very crude and primitive appliances Big shoals of fish seldom come close to the shore It is only the small varieties of fish or the young members of the larger kind that are to be found in the foreshore areas The variety and abundance of fish caught by the Noliyas by their inefficient, and crude methods show how rich the deeper waters off the Orissa coast must be in fish Due to lack of transport facilities from the fishing areas all along the coast to the towns, and railheads the fish caught in these areas is consumed locally or is sun dried, and salted The methods of curing are not always hygienic, and it is very desirable to introduce proper methods of curing fish The possibility of making smoked fish for the present, and dehydrated and canned fish later may be investigated The boats, and fishing nets employed are all locally made but they are crude and primitive Before fishing can be done on a larger scale it would be necessary to introduce improved appliances, and trawlers, and to get the fishermen accustomed in efficiently using them The lack of cold storage, and transport facilities, and of capital to introduce better fishing methods are the greatest obstacles in the way of improvement of marine fisheries, and these difficulties will have to be removed to make marine fishery a success

3 *Estuarine and lake fishery*—There are ample facilities for estuarine and lake fisheries in Orissa These fisheries stretch over a wide area but they are not fully exploited The only source exploited on a large scale at present is the Chilka Lake The shallow regions of the lake covering 200 sq miles constitute the main fishing grounds The lake forms a valuable and compact fishing area, and yields many varieties of tasty fish like mullets, vekti, and prawns Formerly prawns were caught in abundance They were first boiled to remove the shells, and then dried for sending to the Burma market where they were very much in demand The present export of Chilka fish goes mainly to Calcutta at an average of about 80,000 maunds per annum But in the absence of fish-curing yards or a cold storage plant to preserve their catch, the fishermen are at the mercy of the exploiting merchants who dictate the price to be paid for the catch Due to intensive fishing the danger of depleting the fish wealth of Chilka is a real one The adult and big sized fish are gradually becoming rarer The study of the life history of the important varieties of fish, the observance of a close season, the control of the size of the mesh of the nets used, and prevention of catching immature fish below a certain size are some of the problems which should receive immediate attention to conserve the fish wealth of Chilka, and to ensure a continuous supply

The estuarine fishing area is estimated to be nearly 500 sq miles, i e , it is more than double the fishing area in the Chilka lake The estuarine fisheries being directly connected to the sea there is no danger of depletion in their case The river estuaries have no road communication, and there is no outlet for the fish from these areas So they are mostly made into dried fish The estuaries abound in large fish, and there are good possibilities for putting up a canning plant at a central place There is much room for introducing fish curing yards in these areas on modern lines

4 *Inland fishing*—The Province is traversed by a large number of rivers, streams, and canals and there are numerous tanks All these offer a great scope for fish breeding At present the rivers form the chief source of local supplies of fish Cheap supply of fry will help to grow more fish in the rural areas, because people have begun to realise that pisciculture is a paying proposition, even more paying than paddy cultivation They are, therefore trying to develop fish growing in their tanks, and ponds

The above discussions show that Orissa is potentially rich in fisheries but they are insufficiently exploited The catching of fish, and the fishing trade are left in the hands of men belonging to some low castes who due to their poverty, conservatism, lack of education and of knowledge of modern methods of catching and curing fish are hanging on to their old ancestral methods It seems, therefore, necessary that Government should take the initiative in introducing improved appliances, and methods for catching curing and preserving fish in order that the Province may reap the full advantage from her fisheries Difficulty of transport, Smoking, and dehydration would provide great incentive to the development of fish industry According to an estimate there are 18 000 fishermen in the Province, and there would be no dearth of men for the industry But it would be necessary to get some young men trained in modern methods of pisciculture The deep sea fisheries will require the use of trawlers and cold storage plants, and it will be necessary to bring fishing boats, and experts from outside to train our men

C. Tobacco

The tobacco crop constitutes an important source of ready cash to cultivators, and as such its cultivation ought to be encouraged on a vast scale to increase the wealth of the Province In 1942 43 the acreage under tobacco was 29,000 acres, and the yield 10,000 tons The tobacco areas in the districts of Koraput and Ganjam are gradually increasing The possibility of growing virginia tobacco which has been successfully grown in some of the adjoining districts of Madras, in the Ganjam and Koraput areas may be investigated At present the curing of tobacco is done by sun curing Better results could probably be obtained by arranging for flue curing as some varieties of tobacco are best cured by means of artificial heat

Tobacco manufacture in the Province is confined to making cheroots, bidi, and tobacco mixtures for smoking Cuttack specialises in making the product 'Gudakhu' used as a dentifrice for which there is a demand from Calcutta and other markets Equally great is the demand for certain makes of 'Gundi' or chewing powder All these manufactures are carried on as cottage industries But the most important tobacco manufacture which is also done as a cottage industry is bidi making which provides employment, and good wages to hundreds of workers The chief centres of bidi making are Cuttack, and Sambalpur The industry is thriving very well in Sambalpur which offers natural advantages for its growth Sambalpur is the chief centre of supply of the Kendu (*Diospyros melanoxylon*) leaves which are used extensively in bidi manufacture Only a small fraction of the leaves are used in bidi making at Sambalpur and the bulk of them are exported to Bombay, and other places So there is plenty of scope for expanding bidi making as a cottage industry

XVIII. MISCELLANEOUS

A. Timber industries

1 Saw milling

Orissa abounds in forests which are rich in timber There are also extensive areas under forest in the neighbouring States Over a lakh of tons of timber is exported from Orissa per year As all the timber is not brought to a central place it has not been possible to develop saw milling in the Province to the desired extent Leaving out one or two circular saw mills which handle only a small quantity of timber and are side concerns the only saw mill of importance in Orissa is the Paramananda Saw Mill at Russelkonda in the Ganjam district It is a fair sized concern, and uses both circular and band saws There are two band saws one of 4" and the other of 6' in width and several circular saws Its sawing capacity is not at present fully used as it is not getting sufficient replacement of band saws

There seems to be good prospects for setting up a saw mill at the head of the Mahanadi delta somewhere near Cuttack as large quantities of timber are floated down the Mahanadi, and her tributaries from the Orissa and the Orissa States' forests to Cuttack to be sent by rail from there to other places There is also a good demand for sawn timber from the building trade, and furniture manufacturers of which there are quite a good number in Cuttack The greatest users of sawn timber are the railways, and their demand for sleepers during the post war period for laying long lengths of new line in Orissa itself and elsewhere and for building new coaches will provide enough work for the saw mill

2 Timber seasoning

But the whole of the timber sent out from or used in the Province is raw unseasoned timber The articles made with unseasoned timber shrink, and warp after sometime So the woodware industry always prefers seasoned to unseasoned timber although seasoned timber is costlier It will be a great advantage to the Province if a timber seasoning plant could be established at Cuttack To carry overhead electric transmission cables, and telegraph lines wooden posts which are available in abundance in the forests could be used if arrangement could be made for seasoning and properly treating the poles with preservatives Government could encourage the seasoning kiln by using only seasoned timber for their building and furniture purposes The necessary help and advice for putting up the kiln could be obtained either from the Forest Department of the Government of Orissa or from the Forest Research Institute at Dehra Dun The saw mill and seasoning kiln could probably be combined together or be located close to each other as each will serve as an adjunct to the other

3 Match factory

There was sometime ago a match factory at Talcher but for some reason or other it has closed down The match industry can develop at places which have got good supplies of soft wood The Western India Match Company, a powerful Swedish concern, which has captured the markets in Orissa gets some of its supply of soft wood from Orissa The quantity of soft wood that is likely to be available in Orissa and whether it would be sufficient to run a small match factory may be further investigated

4 Plywood

Plywood is required for a variety of purposes such as furniture making, panelling, and body building of motor coaches, etc But the greatest demand for plywood is from the tea industry for making tea chests Most of the plywood made in India these days is used for tea packing The superior type of plywood of which very little is made in India is used in aircraft and marine industries The chief materials required for manufacturing plywood are soft timber, and casein glue Casein is made from milk but as there is great dearth of milk in Orissa protein glues made from flesh of animals or from fish will have to be used As discussed under plastics there are great possibilities for glue making in Orissa from waste animal matter The establishment of a plywood factory in Orissa will provide direct stimulus for the manufacture of glue in the Province Protein glues are being increasingly used in the plywood factories in India As regards

soft wood, it is likely to be available in plenty at a number of places in Orissa The two most suitable places seem to be Cuttack and Malkangiri At Cuttack soft wood from the vast forest areas on the banks of the Mahanadi will probably be able to feed a fair sized plywood factory A plywood factory has been erected at Cuttack, and it has recently started production But the products, have not been able to reach the required standard for want of technical skill and proper attention to the processes of manufacture It is understood that with proper arrangement for seasoning the plies, there is no reason why the product should not be able to match in quality with the plywood made elsewhere in India

Most of the plywood manufactured in India is generally poor in quality as the correct technique of plywood making is not well known in India As a large quantity of superior grades of timber have been used up for war purposes there would be greater need for using plywood in place of solid wood during the post-war period So it is desirable to establish the plywood factory recently established in Orissa on firm footings to meet the post-war needs It would be desirable to have one or two students trained in Sweden or U S A in plywood making so that Orissa's soft woods which are at present only fit to be used as fuel could be put to profitable industrial use

5 Woodwork and furniture

The manufacture of wooden articles such as furniture, boxes, packing cases doors windows, helves, and tool handles etc, is carried on by a large number of people all over Orissa In the district of Cuttack alone, there are about 3,000 carpenters Carpentery plays a very important role in village life and organisation as it supplies all tools, and appliances needed for village crafts The village carpenters also do the work of building and repairing houses, and agricultural implements They are generally paid in kind for doing these hereditary works Furniture making is mostly confined to towns, and its chief centre in Orissa is Cuttack where some 300 families are engaged in this occupation Here the profession has been taken up by people of other castes than the hereditary carpenters The carpenters of Cuttack town have more than a local reputation for their skill in cabinet and furniture making, and they supply furniture to Calcutta and other places where their workmanship is appreciated The industry used to be carried on as a cottage industry by people in their homes but small scale factories have grown up not only in Cuttack but in other towns as well There is a good prospect for this small scale industry at Cuttack because there is a good supply of timber, and the workers possess skill and craftsmanship The post war plans for building institutions, offices work shops, and factories will create a heavy demand for furniture, doors, and windows, etc, and with the rise in the standards of living the industry can be assured of a promising future The development of transport will also need more carpenters to build the body of motor coaches and trucks, bullock carts, and country boats, etc In fact Cuttack with its rivers and canals, and with plenty of timber available at hand, seems to be very well situated for boat building on a large scale It would be a great help to the industry if seasoned timber could be made available to the workers by erecting a seasoning kiln at Cuttack. The Calcutta merchants buy soft timbers from Orissa to make bobbins for jute mills These bobbins could be easily made if a suitable small factory could be put up at Cuttack When a jute mill in Orissa starts working it would be advisable to get all the bobbins it needs made here

The wooden sticks manufactured in the Jajpur subdivision are highly appreciated for their artistic beauty, and fine workmanship But the art is confined to two persons only It would redound to Orissa's credit to have many such artisans trained in this wood carving work which instead of being confined to stick-making only, may be utilised for making other articles, such as trays caskets, and powder boxes etc, according to modern taste

The war order for helves and tool handles gave rise to a new industry in Orissa, and as there are a number of tough woods available in Orissa forests the making of tool handles could also be carried on as a peace time cottage industry As India imports a large quantity of tool handles it would be desirable to try to meet as much of the demand as possible by using the timber available locally The timbers available in Orissa that would be suitable for the purpose are Babul (*Acacia arabica*), Khair (*Acacia catechu*), Dhau (*Anogeissus latifolia*), Phasi (*Anogeissus acuminata*) and Dhamana (*Grewia tiliaefolia*), etc

B. Cottage Industries

Some of the cottage industries have already been discussed under the various class of industries to which they belong Some of the important cottage industries which could not be included in the classified list are discussed below

1 Filigree work

In Cuttack the filigree industry is an important cottage industry and Cuttack is famous for its filigree work which has a large outside market The gold and silver ornaments the various fancy articles caskets, powder cases, and toys, etc, are exported to Calcutta Delhi, Bombay, and even to Europe The presents of Cuttack filigree work which the fighting forces from foreign countries have been sending to their friends and relations at home will help to expand the export when peace returns Some of the articles turned out by the workers from the web like wires of silver or gold using only a few crude appliances are so exquisite in design, and delicate in finish that they are considered as master pieces of art and bespeak highly of the artistic talent of their designers and makers There are about 400 families in the town and 2,000 in the rural areas of the district of Cuttack who are engaged in the manufacture of gold and silver ornaments, and filigree work But as most of them are poor they work only as wage earner, and the maximum benefit of their artistic productions goes to the middlemen, and merchants who are mostly outsiders A great part of the benefits could be secured for the workers by organising them into workers' unions or co operative societies which would guard their interest, and save them from being victims of exploitation

2 Horn and Ivory works

The manufacture of horn and ivory articles is another important cottage industry of Orissa Horn goods are made mostly of buffalo horns, and the chief centre of the industry is the town of Cuttack and Parlakimedi The horn articles of Orissa are exported to Bombay, Calcutta, and many other places, and are highly appreciated The combs prepared are stronger than the imported varieties, and several thousands of them were supplied for use by the fighting forces Besides combs sticks, pen holders, paper cutters tooth brush sticks, and many varieties of fancy articles and toys are also made with horn The polish of the articles could be improved, and their production increased by using labour saving devices such as modern cutting appliances, and small turning and polishing machines Fairly good buttons can be made from horn but their chief defect is that they warp somewhat on washing There is need for experiment to find out how they can be made to withstand washing better The horn scrappings and refuses could be utilised by the introduction of the process of melting and casting them to make moulded articles

3 Toys

Toy making is an important art Cuttack town is famous for its toys Clay toys from Cuttack are sold in almost all parts of Orissa and the neighbouring provinces The manufacture of unbreakable toys is an innovation of the Poor Industries Cottage The articles are being sold not only in Orissa but there is also a demand for them from the Central Provinces, Berar Bombay, and Delhi The industry ought to be put on a commercial basis so as to meet these growing demands The toy industry has great scope for expansion and can command a good market

4 Solapith hats

Previous to the war, Orissa used to get hats from Bengal But first grade solapith grows abundantly in the southern districts of Orissa, and previous to the war used to be mostly wasted To meet the demand of hats for troops, the Supply Department placed an order for 4 lakh hats in Orissa, and that is how hat making began in Orissa A training school was opened in 1942 to train up Oriya workers in hat making Government maintains a hat factory at Cuttack mostly for training workers and to popularise hat making in Orissa Solapith grows almost in all parts of Orissa and there is a fairly good internal demand for hats An export market could probably be found in the Central Provinces when the production exceeds internal demand There is a class of

hereditary solapith workers in Orissa called 'Mali', i e, the garland makers who manufacture garlands, etc, with flowers, and solapith They by their profession are expert workers in solapith, and it is they who should be taught how to make the solapith body of the hats which can later on be finished off with the cloth cover by tailors This new line of manufacture will provide an additional occupation of a permanent nature to the 'Malakars' whose old ancestral profession of making garlands is fast dying out

5 Cane work

Cane grows throughout the districts of Cuttack, and Puri, and in some places in the other districts Split cane is used in the rural areas in Orissa for tying the bamboo framework of thatched roofs and for making baskets to meet the needs of villagers Daspara in the Cuttack, and Banpur in the Puri district are two chief centres of production of cane articles, as the best varieties of cane grow in these localities The cane seats and backs of chairs and settees, etc, are woven by some of the workers who live in or near town areas The Cuttack Jail, the Poor Industries Cottage, and the Madhusudan Village Industries Institute make varieties of cane articles, such as chairs, tables, baskets, and trays etc There is a demand for these articles as they are light and handy but there are not sufficient number of trained workers to make the articles according to modern designs, and taste The need could be met by training a large number of cane workers of the localities where cane grows in sufficiently large quantities By improving the quality, and making cane articles in large numbers they could even find markets outside In order to enable the industry to develop in Orissa cane ought to be made available cheaply to the poor cottage workers, and it ought not to be allowed to go out from the Orissa forests to other provinces

6 Mat weaving

Mats are needed in every home in Orissa and there is great scope for organising mat weaving as a cottage industry Mats are made out of reeds, grasses, jute, and coir all of which are available in plenty in Orissa The particular types of mats known as 'Sapa' are greatly in demand Sapas are made in some villages in North Balasore mostly confined to the Bhograi police station, where the aquatic plants used in making mats grow in abundance It is said that mats worth several thousand rupees are exported from this area by rail, road, and river to other parts of Orissa, and Bengal Mats made with seasoned white reeds are more lasting and fetch better price than those made with fresh reeds Most of the mat weavers being poor, landless labourers, and petty cultivators they cannot stock sticks for seasoning them If sheds could be erected in convenient centres, and the reeds were gathered in season and stocked there for seasoning, better quality mats could be produced during all seasons of the year, and this would provide employment to hundreds of workers

SUMMARY

1 Orissa has not developed industrially as much as the other provinces of India although she possesses considerable scope for industrial development She is fairly well endowed with mineral marine, agricultural, and forest resources which could provide valuable raw materials for the development of industries The development and utilisation of the vast mineral biological and plant products of the sea seem to offer great possibilities of industrial development in Orissa The provision of cheap electric power, and easy transport facilities which are the essential preliminaries to any scheme of industrialisation will greatly help the development of industries in the Province

2 High grade iron ore is available near Umarkot in the Koraput district and somewhat lower grade ore in several small scattered deposits in the Sambalpur district The Umarkot deposit is far away from coal but it may be possible to smelt it using charcoal or hydro electric power when it becomes available It would be easier to get coking coal to Sambalpur but the chief difficulty would be to get the scattered deposits to a central place So both the possibilities seem to be somewhat remote Possibility of improving and extending the cottage production of iron now in vogue in some places in the interior may be investigated

Secondary production of steel using pig iron or scrap, production of ferro manganese, and establishment of a re rolling mill for making structural steels, tools and agricultural implements seem to be possible even now When cheap electricity becomes available it will much facilitate the establishment of such industries

3 The heavy chemical industry, specially the manufacture of salt and salt products, such as alkalies, soda ash sodium hydroxide and bleaching powder, seems to be the most suitable large scale industry for Orissa As regards fine chemicals which are mostly products of coal or wood distillation, the Rampur coal is rich in volatile contents and would be good for distillation purposes There is the possibility of wood distillation A pharmaceutical industry could be started by taking up the extraction of strychnine from nux vomica, agar agar from Chilka weeds, and preparation of shark liver oil and of syrups and extracts from various indigenous medicinal plants By putting up a sulphuric acid plant the manufacture of alums and bichromates could be taken up Rosin oil and scents can be produced on a cottage scale As regards fertilizers there is an immediate need for putting up a bone mill, and calcium cyanamide may be prepared when cheap electric power becomes available by using the chemical grade lime stone available at Kottamete in the Koraput district

4 A paper mill could be had at Cuttack which is very advantageously situated for paper manufacture Besides Cuttack, it has been shown that a paper mill at Motu would be possible even now The possibility of having a mill at Gunupur needs further examination

There is at present no scope for the manufacture of rayons, and artificial plastics The natural plastics available are shellac and resin which are exported Shellac could be made into furniture polish, and insulating varnish, and the use of resin in paper manufacture needs further investigation There seems to be vast scope for making glues from waste animal matter

5 The sugar mill at Rayaghada is only half fed Extension of the cane area at Rayaghada, and the establishment of a new mill at Aska and possibly one at Gunupur seem to be urgently necessary The cane area at Banki may be increased to allow the sugar mill there to develop to a reasonable size Production of alcohol ought to be taken up on a large scale to enable the manufacture of fine chemicals and drugs, lacquers, and varnishes etc , to be taken up in Orissa

6 In addition to the factory at Barang there is another glass factory under construction at Mancheswar The greater use of glass making materials available locally, and the production of better quality glass are problems which need attention A great impetus will be given to the glass industry when the manufacture of soda ash is undertaken in the Province It would be desirable to investigate the possibility of introducing cottage manufacture of glass bangles heads, and small bottles on the same lines as has been done in the United Provinces

hereditary solapith workers in Orissa called 'Mali', i e , the garland makers who manufacture garlands, etc , with flowers, and solapith They by their profession are expert workers in solapith, and it is they who should be taught how to make the solapith body of the hats which can later on be finished off with the cloth cover by tailors This new line of manufacture will provide an additional occupation of a permanent nature to the 'Malikars' whose old ancestral profession of making garlands is fast dying out

5 Cane work

Cane grows throughout the districts of Cuttack, and Puri, and in some places in the other districts Split cane is used in the rural areas in Orissa for tying the bamboo framework of thatched roofs and for making baskets to meet the needs of villagers Dimpara in the Cuttack, and Banpur in the Puri district are two chief centres of production of cane articles, as the best varieties of cane grow in these localities The cane seats and backs of chairs and settees, etc , are woven by some of the workers who live in or near town areas The Cuttack Jail, the Poor Industries Cottage, and the Madhusudan Village Industries Institute make varieties of cane articles, such as chairs, tables, baskets, and trays, etc. There is a demand for these articles as they are light and handy but there are not sufficient number of trained workers to make the articles according to modern designs, and taste The need could be met by training a large number of cane workers of the localities where cane grows in sufficiently large quantities By improving the quality, and making cane articles in large numbers they could even find markets outside In order to enable the industry to develop in Orissa cane ought to be made available cheaply to the poor cottage workers, and it ought not to be allowed to go out from the Orissa forests to other provinces

6 Mat weaving

Mats are needed in every home in Orissa and there is great scope for organising mat weaving as a cottage industry Mats are made out of reeds, grasses, jute, and coir all of which are available in plenty in Orissa The particular types of mats known as "Sapa" are greatly in demand Sapas are made in some villages in North Balasore mostly confined to the Bhograi police station, where the aquatic plants used in making mats grow in abundance It is said that mats worth several thousand rupees are exported from this area by rail, road, and river to other parts of Orissa, and Bengal Mats made with seasoned white reeds are more lasting, and fetch better price than those made with fresh reeds Most of the mat weavers being poor, landless labourers, and petty cultivators they cannot stock sticks for seasoning them If sheds could be erected in convenient centres, and the reeds were gathered in season and stocked there for seasoning, better quality mats could be produced during all seasons of the year, and this would provide employment to hundreds of workers

SUMMARY

1 Orissa has not developed industrially as much as the other provinces of India although she possesses considerable scope for industrial development She is fairly well endowed with mineral, marine, agricultural and forest resources which could provide valuable raw materials for the development of industries The development and utilisation of the vast mineral biological and plant products of the sea seem to offer great possibilities of industrial development in Orissa The provision of cheap electric power, and easy transport facilities which are the essential preliminaries to any scheme of industrialisation will greatly help the development of industries in the Province

2 High grade iron ore is available near Umarkot in the Koraput district, and somewhat lower grade ore in several small scattered deposits in the Sambalpur district The Umarkot deposit is far away from coal but it may be possible to smelt it using charcoal or hydro electric power when it becomes available It would be easier to get coking coal to Sambalpur but the chief difficulty would be to get the scattered deposits to a central place So both the possibilities seem to be somewhat remote Possibility of improving and extending the cottage production of iron now in vogue in some places in the interior may be investigated

Secondary production of steel using pig iron or scrap, production of ferro manganese, and establishment of a re rolling mill for making structural steels, tools, and agricultural implements seem to be possible even now When cheap electricity becomes available it will much facilitate the establishment of such industries

3 The heavy chemical industry, specially the manufacture of salt and salt products, such as alkalies, soda ash, sodium hydroxide and bleaching powder, seems to be the most suitable large scale industry for Orissa As regards fine chemicals which are mostly products of coal or wood distillation, the Rampur coal is rich in volatile contents, and would be good for distillation purposes There is the possibility of wood distillation A pharmaceutical industry could be started by taking up the extraction of strychnine from nux vomica, agar agar from Chilka weeds, and preparation of shark liver oil, and of syrups and extracts from various indigenous medicinal plants By putting up a sulphuric acid plant the manufacture of alums and bichromates could be taken up Rosin oil, and scents can be produced on a cottage scale As regards fertilizers there is an immediate need for putting up a bone mill, and calcium cyanamide may be prepared when cheap electric power becomes available by using the chemical grade lime stone available at Kottameta in the Koraput district

4 A paper mill could be had at Cuttack which is very advantageously situated for paper manufacture Besides Cuttack, it has been shown that a paper mill at Motu would be possible even now The possibility of having a mill at Gunupur needs further examination

There is at present no scope for the manufacture of rayons, and artificial plastics The natural plastics available are shellac, and resin which are exported. Shellac could be made into furniture polish, and insulating varnish, and the use of resin in paper manufacture needs further investigation There seems to be vast scope for making glues from waste animal matter

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6 In addition to the factory at Barang there is another glass factory under construction at Mancheswar The greater use of glass making materials available locally, and the production of better quality glass are problems which need attention A great impetus will be given to the glass industry when the manufacture of soda ash is undertaken in the Province It would be desirable to investigate the possibility of introducing cottage manufacture of glass bangles, beads, and small bottles on the same lines as has been done in the United Provinces

There are vast possibilities for making fireclay refractories, stoneware, and white porcelainware The best centres for the manufacture of these articles would be Jharsuguda in the Sambalpur district, and a place near Bhubaneswar in the Puri district There does not seem to be much scope at present for making enamelware in Orissa The making ought to be introduced on a large scale The manufacture of graphite refractories, lubricants, and other products can be taken up in collaboration with the Patna and Kalahandi States by putting up a flotation plant at a central place for purifying the graphite ores obtained from these areas

The possibility of developing a cement industry in the Sambalpur district by utilising the huge limestone deposits at Dungri seems to be more favourable than that in the Koraput district which has got good quality limestone deposits at Kottametta In the absence of coal it would be better to utilise this chemical grade limestone later in electric furnaces for making valuable products like calcium carbide, and calcium cyanamide

7 To push up the production of soap which has become an article of every day use for many it would be necessary to increase very much the production of oil in the Province There is plenty of ochre but little linseed oil to develop the paint industry Ganjam grows plenty of groundnuts, and there is at present a move to install a vegetable ghee plant at Berhampur

8 If hydro electric power can be obtained cheaply the electro metallurgical and chemical industries, such as the extraction of aluminium, production of calcium carbide, and cyanamide, and of artificial abrasives like carborundum, and alundum may be taken up in future

9 A textile mill for Orissa is a crying need The demand for yarn from hand loom weavers alone could provide work for several spinning mills A great good could be done to the handloom industry which is the chief cottage industry in the Province by organising the workers on co operative lines

10 There is no wool industry in the Province and the silk industry is dying out for want of silk and cocoons The culture of eri silk seems to have good scope for development in the Province A fairly good quantity of hemps and coir is available in the Province, and it ought to be utilised for rope making Sisal could be grown at many places in the Province There is enough market for the hosiery industry which could be introduced as either small scale or cottage industry Orissa grows plenty of jute, and there is ample scope for a good jute mill

11 The brass and bell metal industry which is an important cottage industry is in urgent need of improvement by introducing labour saving mechanical devices Manganese is the only non ferrous metal available chiefly at Kutingi in the Koraput district The deposit is easily accessible, and can be exploited for export But it would be desirable to utilise it in the Province in chemical and glass industries, and in producing ferro manganese

12 There is a vast scope for the tanning and leather goods industry in Orissa as both skins and hides, and tanning materials are available in plenty Except for a few small tanning establishments, and production of leather goods by cottage workers, there is at present no factory production of leather or leather goods in the Province

13 The development of the fishing industry holds great possibilities for Orissa Introduction of deep sea fishing cold storage, dehydration, and canning will help the speedy growth of the industry It might be possible to have a small industry for canning and bottling of some fruits and vegetables, and for preparing fruit syrups lemon, and orange squash, etc As regards tobacco products bidi making is a growing cottage industry at many places in the Province

14 As regards timber industries a plywood factory has already started working, and there is scope for erection at Cuttack of a saw mill a seasoning kiln, a jute bobbin and helve factory, and possibly a match factory

15 Besides the fancy handloom products the other cottage industries which have made Orissa famous are the filigree work of Cuttack, and the horn and ivory work of Cuttack and Parlakimedi These cottage industries need organisation, and improvement Hat making cane work, and mat weaving are useful cottage industries which could be organised on a wide scale in the Province

APPENDIX

List of Industrial Establishments operating under the Factories Act of 1934, in Orissa

Sl. No	Place	Name of Establishment	Description of Industry
1	2	3	4
		CUTTACK DISTRICT	
1	Jobra Cuttack	Jobra Government Workshop	General Engineering
2	Cuttack	Orissa Mission Press	Printing
3	Chauliaganj Cuttack	Orissa Rice and Oil Mills	Rice (Secondary products dal oil and oat)
4	Ditto	Bhima Ice Factory	Ice
5	Jobra Cuttack	Orissa Engineering School Workshop	General Engineering
6	Byree	Sree Jagadish Rice Mill	Rice
7	Cuttack	Utkal Sahitya Press	Printing
8	Do	Saraswata Press	Do
9	Do	Satyabadi Press	Do
10	Chauliaganj, Cuttack	Kasambhai Manji Oil Rice and Flour Mills	Rice
11	Cuttack	Arunodaya Press	Printing
12	Do	Cuttack Electric Supply Co Ltd	Electric Power House
13	Barang	Sree Durga Glass Works	Glass
14	Chaul aganj	Karson Rice Mill	Rice
15	Byree	Swastika Rice Mill	Rice
16	Cuttack	Government Press	Printing
17	Baitarani Road	Mahalakshmi Rice Mill	Rice
18	Cuttack	Orissa Kohinoor Press	Printing
19	Ban i	Charchika Sugar Mills	Sugar
		PURI DISTRICT	
20	Jatni	Sree Biswanath Rice Mill Ltd	Rice
21	Do	Jatni Rice Mill	Do
22	Khurda Road	B N R Engine Shed	Railway Workshop
23	Tangi	Raghunath Rice Mill	Rice
24	Sakhigopal	Sakhigopal Rice Mill	Do
25	Puri	Puri Electric Supply Co Ltd	Electric Power House
26	Jatni	India Industries Ltd	Engineering
		BALASORE DISTRICT	
27	Balasore	Balasore Technical School Workshop	General Engineering
28	Jaleswar	Bhairodhan Jethmal Rice and Oil Mill	Rice
29	Basta	Bijoy Rice Mill	D
30	Balasore	Murlidhar Gopikissan Rice Mill	Do
31	Rupsa	Rupsa Rice Mill	Do
32	Balasore	Utkal Rice Mill	Do
33	Do	Singhabahini Rice Mill	Do
34	Soro	Annapurna Rice Mill	Do
35	Haldipada	Chandi Rice Mill	Do
36	Balasore	Sree Ganesh Ice and Rice Factory	Do
37	Basta	Sankar Rice Mill	Do
38	Lakhamannath Road	Mahamaya Rice Mill	Do
39	Do	Sree Sree Durga Rice Mill	Do
40	Khantapara	Sreedam Chandra Rice Mill	Do
41	Do	Satyanarayan Rice Mill	Do
42	Jaleswar	Saraswati Rice Mill	Do
43	Kantapara	Jagadhatri Rice Mill	Do
44	Amarda Road	Amarda Road Rice Mill	Do
45	Rupsa	Sree Hanuman Rice Mill	Do
46	Bahanaga Bazar	Bajrangabali Rice Mill	Do.
47	Rupsa	Annapurna Rice Mill	Do
48	Markona	Raghunarayan Rice Mill	Do
49	Chandbali	Chandibali Rice Mill	Do
50	Do	Baitarani Rice Mill	Do
51	Charampa	Sree Balaji Rice Mill	Do
52	Amarda Road	Prafulla Rice Mill	Do